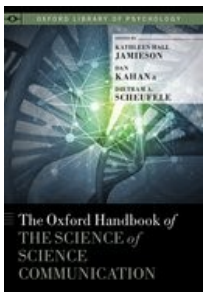

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CHAPTER

4 How Changing Media Structures Are Affecting Science News Coverage

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Abstract

Many citizens and decision-makers obtain information about science mainly, or even exclusively, from news and online media. Accordingly, social science has devoted considerable attention to the analysis of science news coverage. A review of this literature reveals a number of ongoing, substantial transformations: In line with the crisis of legacy media, the rise of online communication, and the extension of PR by many societal stakeholders, science communication is changing. Science journalism has come under pressure in publishing houses, and science journalists' working conditions have worsened. The amount of science news coverage is stagnating, albeit after a rise that lasted several decades, and seems to navigate toward either a more controversial reporting about politicized issues such as gene editing or a less critical "churnalism" that is more strongly influenced by PR efforts than before. The implications of these changes for science communication and societal decisions regarding science communication are considered.

Keywords: science communication, science journalism, science news, legacy media, online communication, social media

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Modern science is a peculiar enterprise employing its own, specialist modes of communication, epistemic routines, and jargon. It is complex and in many respects detached from society, and, as a result, citizens and many decision-makers obtain their information about science mainly, or even exclusively, from news media and, increasingly, from online media. The way those media present science—their coverage of topics such as stem cell research, gene editing, climate modelling, or particle physics—plays an important role in elevating selected science issues onto the public agenda, contributes to science's public image and trustworthiness, steers how these issues are discussed, and influences their legitimation and public support (e.g., Bucchi and Trench 2015; Fischhoff and Scheufele 2013).

Therefore, social science, and communication science in particular, has devoted considerable attention in recent decades to the analysis of news media coverage of science; its institutional, sociocultural, and technical preconditions; and its effects on various audiences (Schäfer 2012). The considerable body of scholarly knowledge that has been established so far shows an ongoing "tectonic transformation" (Scheufele 2013, 14042) of science news coverage and its preconditions. In this chapter this transformation is surveyed in three steps. In the first section, changes in media systems and audience behavior—both in general and with a specific focus on science issues—are discussed as they relate to science news coverage. In the second, the effects of these changes on the profession of science journalism and on its output, science news coverage, are portrayed. In the final section, the implications of these changes for science communication as well as their importance for societal decisions regarding science communication are considered.

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General and Science-Related Changes in the Media System and in Audience Behavior

Patterns of public communication in many countries are currently changing. Particularly relevant antecedents for science news coverage are three, mutually intertwined facets of this change:

Firstly, *legacy news media have come under pressure* in many countries. The US newspaper industry, for example, has shrunk by 40% over the past decade (Dunwoody 2015, 29), and full-time positions and average wages for US journalists have been in decline since 1990 (Brainard 2009; Weaver et al. 2007). "In the USA, Canada and Europe, the traditional news business model—i.e. the selling of news in return for advertising and reader subscriptions—seems to be in crisis" (Bauer et al. 2013, 4). Newspapers, news magazines, TV, and radio news are losing influence, with circulations, viewership, and, subsequently, advertisement revenues shrinking. This has led to publishing houses shedding staff, cutting salaries, reducing the frequency of appearance, or switching to online-only publication (e.g., Bauer and Gregory 2007, 46).

Second, this decline is complemented by, and intertwined with, the *emergence and growth of online and social media*. After the World Wide Web was established, the number of available websites rose sharply to an estimated 1 billion, which are now accessed by approximately 3 billion people worldwide. Apart from this quantitative growth, online communication also changed in nature, toward interactive, many-to-many communication in which user-generated content can be exchanged and the distinction between senders and receivers is blurred (i.e., toward "Web 2.0" applications or "social media"; Kaplan and Haenlein 2010). Increasingly, audiences are turning into active participants that are not only able to comment upon, evaluate, share, and recommend journalistic content but to produce and publish their own content, from small-scale blog posts to elaborate collaborative projects like Wikipedia (cf. Benkler 2006; Jenkins 2006). This rise of online and social media is mirrored in changing information-seeking patterns among audiences. While news media, and particularly television, are still the preferred source of information for many citizens, online sources are quickly closing the gap (for data on European countries, see Eurobarometer 2014b; for the United States, see PEW Internet and American Life Project 2014). This also applies to information about science:

> Recent studies have shown significant shifts among audiences away from traditional news (mostly television and newspapers) as primary sources for scientific information and toward news diets that are heavily supplemented by or rely exclusively on online sources as the primary source for scientific information. Most of this development is due to cohort shifts, especially among younger audiences, who are growing up without news diets dominated by print newspapers or television

> and are therefore significantly more likely to develop news use habits based on online-only sources for science news or at least to supplement use of traditional outlets with online sources.
>
> (Scheufele 2013, 14041)

This trend is particularly pronounced in the United States and, seemingly, in industrialized Asian countries, where online sources are already more frequently used to seek information about science than other media (Brossard 2013; Brossard and Scheufele 2013). For European countries, surveys demonstrate that online media are increasingly used as sources for information about science as well (e.g., BBVA Foundation 2011; Eurobarometer 2014a) but less often than in the United States.

While cause and effect are difficult to entangle here, it is clear that the decline of legacy media and the rise of online media have coincided and that the shift to online media has come at the expense of news media (Scheufele 2013, 14042). This corresponds with a third trend: the decline of legacy news media and the rise of online media provide "growing opportunities for 'those in politics, government, agencies, companies and others to take their messages to a public' " (Friedman 2015, 147; cf. Williams 2015) directly. With the waning and changing role of professional gatekeepers such as journalists, a *pluralization of public communication* is visible. More, and more diverse, voices like "scientists, journalists, advocates, and the people formerly known as audiences are all content contributors, each with varying knowledge, background and perspectives" (Fahy and Nisbet 2011, 782). Generally, power relations between journalists and societal stakeholders have changed (Bauer and Gregory 2007; Göpfert 2007). With regard to science communication, this is manifested in several ways: in scientists increasingly realizing "the value of public visibility and tak[ing] active steps to structure their own public images" (Dunwoody 2015, 35), which internationally comparative surveys have shown for disciplines such as epidemiology, stem cell research, or climate science
p. 53 (e.g. Dudo 2012; Peters et al. 2008); in an increase and professionalization in the PR of ↳ scientific organizations, which has been diagnosed many times but which has yet to be systematically shown for a broader set of scientific organizations (e.g. Williams 2015); and in an increasingly pluralistic, participatory "science media ecosystem" (Fahy and Nisbet 2011) in which

> opinion leaders other than scientists, such as religious leaders, nongovernmental organizations and politicians, have been successful in formulating their messages about science in a manner that connects with key stakeholders and publics but at times might directly contradict scientific consensus or cut against the interests of organized science.
>
> (Bubela et al. 2009, 515)

Changes in Science Journalism

The ongoing crisis of legacy media, the rise of online and social media, and the increasing volume and plurality of public communication about many issues—including science—also affects science communication and science news coverage in particular. It has effects on science journalists, their professional status, their work, and their output.

The Changing Profession of the Science Journalist—and New Models

Science has long been a low priority topic for many media, at least compared to domestic and foreign politics, business, sports, or culture and art. Accordingly, science journalism originated late historically;

> it took the technological innovations catalyzed by World War II, post-war decisions by governments in several countries to invest in scientific research, the space race of the 1960s and

> the growing environmental concerns of the 1970s and 1980s to galvanise media organisations into finding science and environmental reporters to cover what loomed as some of the major stories of the century.
>
> (Dunwoody 2015, 29)

But even so, many media outlets have never established science desks, and the ones that did and still do are typically situated in large TV stations, public service broadcasters, broadsheet newspapers, quality weeklies, or specialist publications. The minor role of science journalism in publishing houses also manifests itself in staffing structures, as science journalists only make up between 1% and 2% of journalists in countries such as the United States, Germany, Switzerland, or Norway (cf. Schäfer 2011, 403f.).

But *even these comparatively low numbers are decreasing further in the current situation.* With audiences increasingly turning toward new, online entry points into the information environment, and with advertisers correspondingly moving toward online platforms and search engines like Facebook or Google, traditional journalistic media face considerable economic difficulties. Many of them address these by reducing costs, shedding staff, and closing desks, and this seems to apply in particular to specialist reporting, which is comparatively expensive. In this context, "it is all too often the case that science news is regarded as expendable," seen as "a luxury increasingly difficult to justify when certain other types of news will be both cheaper to produce and more popular with audiences (and thus advertisers)" (Allan 2011, 773). As a result, there are fewer science sections and science journalist positions, which seem to be concentrating even further in a small number of publishing houses. Of the ninety-five science sections in US newspapers in 1989, for example, only nineteen still exist (Dunwoody 2015, 29). TV stations such as CNN have cut their science news staff, and many science journalists report that jobs are being lost in their publishing houses (Brumfiel 2009, 274). Similar trends, albeit seemingly less drastic, are observable in other Western countries. As a result, less expertise on specialist science issues remains in media houses, and the "vast majority of articles on emerging technologies are written by reporters whose primary responsibilities do not involve scientific topics," which may cause problems for issues "such as nanotechnology, that combine complex basic research, high levels of scientific uncertainty, and multifaceted policy dilemmas" (Scheufele 2013, 14042) that are difficult to understand and where an informed societal debate is seen as necessary by many.

In addition, w*orking conditions for the remaining science journalists in legacy media are changing, and, in many respects, getting worse.* The ongoing integration of legacy and online media has established an instantaneous, 24/7 news culture in which information has to be processed continuously (e.g., Allan 2011), in which journalistic response times have been reduced considerably (e.g. Kristiansen et al. 2016), and in which cross-media production processes often demand that journalists prepare and adapt content for different channels (e.g., Bauer et al. 2013). Because these demands have to be met with fewer resources, science journalists' workloads are rising.

> 59% of [international science] journalists have seen the number of items they work on in a given week ↳ increase over the past five years. They are not just doing more reporting, but more types of reporting. Many are now being asked to provide content for blogs, web stories and podcasts—something they weren't doing five years ago.
>
> (Brumfiel 2009, 275)

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Therefore, many scholars see working conditions for science journalists worsening overall, and the small number of available science journalist surveys supports this (e.g., Bauer et al. 2013; Brumfiel 2009; Kristiansen et al. 2016). Nevertheless, a number of studies have emphasized that the *advent of online media has also had positive effects on science journalists*. Surveys indicate that, on average, science journalists spend

several hours a day online looking for and researching story ideas, and many indicate that in this respect, the Internet has "made their job easier" (e.g., Bauer et al. 2013, 19). Online communication also provides science journalists with more immediate feedback—which partly adds to newsroom pressures as click rates provide instantaneous assessments of story "success" (Bauer et al. 2013, 19) but also enables a more dialogical, participatory journalism (Fahy and Nisbet 2011, 785) in which more perspectives can be taking into account and in which stories can be edited accordingly, even continuously (cf. Dunwoody 2015).

In connection with these changes in the professional context of science journalists in many countries, the *roles of science journalists have diversified, and new individual and organizational business models have emerged*. While a (potentially shrinking) majority of science journalists seemingly still view themselves primarily as explainers of complex issues to an interested lay audience, or as watchdogs toward science—embodying two of the classical roles of journalists (cf. Schäfer 2011)—other roles "such as 'information specialist' and 'critical analyst' are likely to be[come] more important than 'neutral information broker' or the traditional reporter" (Fahy and Nisbet 2011, 785) in the future. Furthermore, individual "science journalists are being forced to become more entrepreneurial," that is, to use legacy media as well as books, websites, and "social media channels—Facebook, Twitter—not only to maintain contact with sources and peers but also to build their own personal brands" (Dunwoody 2015, 36). Above the level of individual journalists, a range of new business models for science journalism has emerged or been called for. A first variant is "philanthropic" journalism, in which reporters and editorial work are financed by third parties like foundations, as is the case in Switzerland's most widely circulated, free newspaper *20 Minuten,* whose two regular "Knowledge" pages are written by external science journalists that are sponsored by two Swiss foundations (cf. Koch et al. 2013). A second option that has been tried is crowdfunded journalism (an example is the German science magazine *Substanz*, which appears online only) and donation-funded journalism (like the Pulitzer Prize–winning *InsideClimateNews* site in the United States). A third variant are "science media centers" (SMCs) that have been established in the UK, Japan, Germany, New Zealand, and elsewhere. Employing professional science journalists, building up a large expert database, and providing quick responses to science-related issues as they come up, SMCs aim to function as independent press offices helping media and journalists without the respective expertise through relevant information and fact checks (Williams 2015, 199; Rödder 2014). Given the state of current scholarship and the relatively recent emergence of these new business models, however, it is difficult to say to what extent such enterprises have been, or will be, able to compensate for shrinking science journalism infrastructures elsewhere, and it might take "years before successful models for delivery of substantive science journalism emerge from the bevy of experiments now under way" (Dunwoody 2015, 27). A scholarly assessment of these models and developments is much needed, both to provide the science of science communication with insights into new modes of science journalism and to assist the respective endeavors in identifying (un)successful ways of science communication.

Changes in Science News Coverage

In addition to the changing working conditions for science journalists, and those closely connected to them, science news coverage also has evolved in recent decades.

A change is visible, first, in that the recent *growth in the amount of media coverage dealing with science and related topics seems to have stopped*. Science has never been a major media topic, with studies in the United States, Australia, Germany, and Greece, for example, finding between 1% and 3% of media coverage devoted to science (Dunwoody 2015, 29). In the second half of the twentieth century, however, studies and meta-analyses found a clear, almost linear increase of media stories about science and technology in the United States, Germany, Italy, the UK, and Bulgaria (Schäfer 2011, 404). This rise, however, seems to have stopped in the early ↳ 2000s, with the share of science news, in comparison to other news issues, stagnating (Bauer 2011; see Fig. 4.1).

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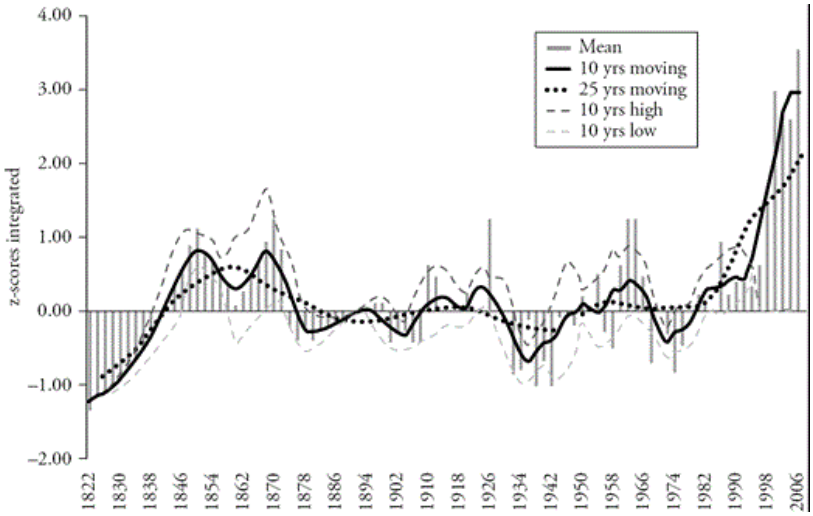
Figure 4.1



Index of science news fluctuations, above and below the long-term trend.

Source: Bauer (2011, 42).

Second, *science news coverage about a number of issues has become more pluralized, and, on some issues, more controversial and politicized*. Along with the increasingly plural "science media ecosystem" (Fahy and Nisbet 2011), a broader array of arguments about and perspectives on science has emerged. Their proponents successfully use online opportunities, professional PR, and the opportunities provided by a weakened science journalism to make their positions visible in news coverage. Accordingly, media coverage on issues such as stem cell research, green biotechnology, climate science, and gene editing has become more diverse and, at times, strongly contested, with large portions of the coverage appearing outside of science sections, featuring a majority of nonscientists as sources, discussing ethical, legal, and social frames and being ambivalent or even critical in tone (Schäfer 2009). On the one hand, this has been interpreted positively, as a constructive societal feedback highlighting potentially problematic facets to scientific innovators (Bauer 2013). On the other hand, diversification has also been tied to trends of fragmentation and polarization in science debates (cf. Scheufele 2013; see also Chapter 3 in this volume). The prevalence of such trends still has to be assessed, however, in studies comparing different scientific issues (cf. Schäfer 2007, 2009). After all, and in contrast to cases of intense debates, coverage on science issues such as high-energy physics has not changed significantly over time and still follows a "popularization" mode of media reporting that takes place in science sections, features scientists as main or even exclusive sources, a scientific framing, and an affirmative tone (Schäfer 2011, 405f.). It is therefore still unclear—albeit plausible given the aforementioned changes in the structural and economic context of science journalism—whether science news coverage in general is becoming more plural and controversial.

Research on this question is necessary as a third, general trend in science news coverage exists that may partially counteract the described pluralization and increase in controversy: a number of scholars have diagnosed a *development "from a logic of journalism … towards a source-driven reportage of science"* (Bauer and Gregory 2007, 33; cf. Göpfert 2007) in recent years. Science journalists have always been source-dependent, and more so than other journalists.

> Some 50,000 journals and more than one million scientific papers are published annually[,] and sorting through and choosing sources is as crucial as it is difficult. The literature shows quite convincingly that science journalists tend to solve this problem by sticking to the measures of relevance that are provided by science itself: They rely on a rather small number of influential

> scientific journals as primary sources, particularly "Nature" and "Science" ... and generally exhibit a rather strong source dependence.
>
> (Schäfer 2011: 406)

p. 56 With the rise and institutionalization of science journalism in a larger number of media houses in the second half of the twentieth century, it distanced itself from science and reduced its source dependency, and longitudinal studies show that the tone of coverage has become more critical over time (Bauer et al. 2006). But this seems to have changed again. In a situation where resources are scarce, it may be that "time-pressed reporters [are] increasingly reliant on information subsidies from scientific institutions, universities and public relations agencies to find material" (Fahy and Nisbet 2011, 784). Studies assessing this trend are still rare, however, and more evidence is needed. But first indications are that more science news in the media is based on PR materials nowadays, that more PR texts are taken up or quoted directly in media coverage (e.g. Williams 2015), and that exaggerations present in PR material about science are mirrored in press coverage (Sumner et al. 2014). The result may be that science journalism, after emancipating itself as an increasingly critical, autonomous branch of journalism (again), moves toward a celebratory, affirmative style of coverage—maybe even toward "Churnalism and McNews type science news production" (Bauer et al. 2013, 27; cf. Allan 2011).

A fourth trend is that *science news is increasingly presented to audiences in multiple, partly new contexts and with novel contextual cues.* The conventional production of science news for only one medium and one way of consumption—that is, for print- or TV-only presentation—has become an exception. In almost all cases, science news is presented in different media simultaneously, or consecutively, from legacy media over social media, free or commercial news aggregation sites like Google news or Blendle (Brumfiel 2009). Accordingly, science news appears in connection with news and media pieces from very different media and on different topics (cf. Brossard 2013, 14097). In addition, such stories are presented alongside contextual cues like social recommendations, commentary, and evaluations such as likes or shares. First studies suggest that these new contexts and contextual cues influence not only how people perceive science news pieces but also the effects that those news have on audiences (e.g., Anderson et al. 2014).

Implications and Outlook

The described changes are ongoing, and scholarship is struggling to keep pace. According to Dunwoody,

> We are too early in the process of change to determine what occupational modifications will strengthen and which ones will fade. Scholars are just beginning to explore the impeacts of these changes, making it difficult to assess the societal risks and benefits that accompany them. (2015, 36)

A number of tentative conclusions can be drawn, however, that contextualize the outlined trends and highlight directions for future research.

The review of scholarly literature on science journalism, science news, and their preconditions shows a number of substantial, ongoing changes. In line with the crisis of legacy media, the rise of online communication, and the extension of PR by societal stakeholders, science communication is changing. Science journalism has come under pressure in publishing houses, potentially even more so than other desks, and the respective journalists' working conditions have worsened. The amount of science news coverage is stagnating, albeit after a rise that lasted several decades, and seems to navigate toward either more controversial reporting about politicized issues such as gene editing (e.g., Scheufele 2013) or a less

critical "churnalism," which is more strongly influenced by PR efforts than before (e.g., Bauer and Gregory 2007).

These developments have implications for science communication researchers as well as decision-makers in the field. First, *a scholarly debate about the different shapes of science journalism, and their boundaries, in changing science media ecosystems is necessary*. The emergence of new journalistic roles (Fahy and Nisbet 2011) and the increasingly hybrid character of many journalists' occupational profiles who may work partly for media, partly for other outlets from blogs to press offices, makes it more difficult to determine what a science journalist is. "Similarly, what is a science news story? Does a tweet count? A blog post? And even when a story looks like the traditional stereotype of a news narrative, when is it a *finished* narrative?" (Dunwoody 2015, 37).

Second, *the prevalence of the described changes should be assessed in future studies*. On the one hand, this should be done by broadening the empirical basis for analysis (more) beyond North American and European countries. Historically, research on science journalism has focused primarily on Anglo-American countries (Schäfer 2012), and, accordingly, findings from these countries are strongly represented in the literature. But there are indications that "the climate in the global south is very optimistic with regards to science journalism" and that "Churnalism and McNews type science news production is expected mainly in Europe,
p. 57 USA ↳ and Canada, and less so elsewhere" (Bauer et al. 2013, 27, 32; cf. Russell 2009a, 2009b). On the other hand, science journalists seem to be particularly "embattled" in countries with "liberal" (Hallin and Mancini 2005), commercial media systems like the United States, where "anecdotal accounts suggest that science journalists … increasingly find themselves on their own, in the ranks of freelancers as their former media organisations downsize" (Dunwoody 2015, 30). In countries with a stronger public service broadcasting sector, like the UK, Germany, France, or Switzerland, however, things appear less problematic, even though the overall trends are the same (e.g., Dunwoody 2015; Brumfiel 2009, 275; Kristiansen et al. 2016). An assessment of the described trends in different contexts could illuminate not only differences in their characteristics but also the role of contextual factors such as publicly financed (science) journalism. Apart from comparisons across countries or media systems, comparisons of science journalism and science coverage across different issues and media as well as over time would also be necessary additions to the available scholarship.

Third, the *normative implications of a changing interplay between science journalism and audience behavior have to be considered*. On the one hand, an increasing amount of science-related information is available for public consumption nowadays. There is "an abundance of cable television, Internet and digital resources for the public to inform themselves about science and its social implications" (Bubela et al. 2009, 514), with a broad range of positions and arguments toward science and with different degrees of quality. In this situation, finding "good information requires effort on the part of the individual searcher, effort that the typical individual rarely expends" (Dunwoody 2015, 27). Paradoxically, the guidance science journalists could provide is more needed than ever, but they may be less and less able to provide it. On the other hand, this problem might be catalyzed further by an existing, and potentially increasing, fragmentation of the science communication audience. "[P]eople go to places they feel comfortable" (Brumfiel 2009, 277) to get the amount and kind of science-related information they prefer. This also means, however, that they might "avoid science media altogether" or prefer "news sources that confirm and reinforce their pre-existing beliefs" (Bubela et al. 2009, 514f). In social media, where this self-selection might be furthered algorithmically, "self-reinforcing informational spirals" (Brossard and Scheufele 2013, 41) might emerge that produce "echo chambers" (Sunstein 2009) and "filter bubbles" (Pariser 2011) in which scientific topics or alternative viewpoints on them are systematically under-represented or even absent.

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