Repercussion and resistance: An empirical study on the interrelation between science and mass media

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Abstract

The article employs the mediatization concept to analyze the relationship of science and the mass media. It draws on theoretical considerations from the sociology of science to distinguish and empirically investigate two dimensions of mediatization: changes in media coverage of science on the one hand and the repercussions of this coverage on science on the other hand. Results of content analyses and focused expert interviews show that mediatization phenomena can indeed be observed in the case of science, but they are limited to certain disciplines, to certain phases (mediatization phases differ from routine phases in which the media tend to acknowledge scientific criteria, routines, and knowledge), and to a small number of media visible scientists. We conclude that media-induced structural change in science, though present, is less pronounced than mediatization of other parts of society. Compared to spheres such as politics and sports, science's media resistance is rather high.

Keywords: mediatization of science, media coverage, content analysis

Introduction

Mediatization is a central concept in analyzing media-related social change. While the term has been used to describe different phenomena (Livingstone, 2009; Schrott 2009), the core concept is that mediated communication is increasingly relevant to society. Mediatization includes structural changes both within the media as well as within other social systems that react to change in the media and encompasses both adaptation and resistance to mediated communication. Scholars in media and communication studies are still debating the appropriate technical term as well as the structure of mediatization (e. g., Lundby, 2009b)[1].

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Most literature understands mediatization, implicitly or explicitly, to include all media working "as a technology, as a societal institution, as an organizational machine, [as] a way of setting content in a sense, and as a space of experience of a recipient" (Krotz, 2009, p. 23). This broad definition includes newspapers, radio, TV, internet, film, mobile phones, computer games, or software tools, among other types of media. The concept is often employed to analyze developments on the micro-level, such as how individuals change their video game or mobile phone use (Krotz, 2007, pp. 161–176, 179–183). Another branch of mediatization research, in contrast, focuses on macro-level factors, and views mass media as a social system in its own right. Scholars in this branch are interested in how the media system relates to other parts of society, most notably the political system (e. g., Kepplinger, 2002; Marcinkowski, 2005; Vowe, 2006), but more recently also sports (Marr and Marcinkowski, 2006; Dohle and Vowe, 2006), religion (Hjarvard, 2008; Hepp and Krönert, 2009), and law (Kepplinger and Zerback, 2009).

This article employs the macro-level perspective of mediatization and analyzes the interrelation between the mass media (hereafter, just "media") and science. We define mediatization as the dynamics of the relationship between science and the media, both understood as social systems that can be analytically and empirically differentiated, despite the fact that they mutually influence and (re)construct each other's functioning and complexity.

The basis for our analysis and theory comes from the sociology of science. We first outline several assumptions and present two analytical dimensions: science news coverage and the repercussions of media attention on science (section 2). We then provide empirical evidence for these dimensions, which suggests that, under normal or "routine" conditions, the media look to science for its lead (rather than vice versa). Section 3 shows that mediatization only occurs under certain conditions, and that it is characterized by complex processes of mutual reinforcement. Drawing on our data and on the literature, we conclude with some thoughts on the temporal, material, and social aspects of the science-media relationship (section 4)[2].

Indicators for the mediatization of science

Modern science, the systematic way of producing knowledge, was established and institutionalized in the early 19th century (e. g., Felt et al., 1995, pp. 30–39). Because science's main audience is not a public one, it differs from other sectors like politics, art, religion, or sports, each of which cater to voters, connoisseurs, believers, and fans. Instead, modern science has distanced itself from the outer world, as can be seen by the following: Its institutions have established their own codes of (scientific) conduct (Merton, 1973); a higher educational degree is now a precondition for inclusion, i. e., science became a profession (Felt et al., 1995, pp. 39–43), and, due to the creation of multiple scientific disciplines, specialists supplanted generalists (Stichweh, 1988). The scientific community has pushed away external influences, like religion and politics, and kept its proceedings away from the public eye. Instead, science has relied on its own public sphere of peer communities, conferences, and scientific journals. For much of science's existence since the early 19th century, scientists have not considered society at large to be a relevant audience (Weingart, 2005).

Many authors, however, think this has changed in recent years. Some of them have stated that scientific institutions have become intertwined in a "triple helix," in which they (have to) cooperate with companies and government actors (Etzkowitz and Leydesdorff, 2000; Etzkowitz, 1990). Others argue that science has become "contextualized" (Nowotny et al., 2001, pp. 96–120; see also Gibbons et al., 1994).

Peter Weingart describes this process as a "loss of distance" between sub-systems of society (Weingart, 2001, p. 124; 2002, p. 703). Drawing on differentiation theory, he argues that science has become "more tightly coupled" with the political, economic, and media systems respectively (cf. Weingart, 2001, 2003).

Based on an understanding of the media and of science as systems in their own right (Weingart, 1998; Rödder et al., forth.), Weingart characterizes the mediatization of science ("*Medialisierung*" in his terms) by outlining two trends (e. g., Weingart, 2005, p. 28): First, he diagnoses that the representation of science in the media has changed; second, he notes an increase in the orientation of science towards the media. This paper will both elaborate on this theory as well as assess these claims empirically.

Mediatization as changing science coverage

Weingart suggests that there is a "loss of distance" between science and society in both an increase and a change in news reporting on science. Historically, science did not garner much media attention as compared to other societal issues. And when media reported on science, they usually presented it "du chef" (Bucchi, 1998, p. 2), popularizing it by adopting the scientists' perspective, criteria of relevance, and predominantly positive evaluations of their own research (cf. Kohring, 1997, pp. 65–85). Science journalism functioned, in other words, as a "transmitter" or "translator" of science to a broader audience (Braun et al., 2002, p. 7).

Weingart and others claim that this has changed, i. e. that science now receives more and a different kind of media coverage (e. g., Bucchi, 1998; Elmer et al., 2008; Felt et al., 1995; Lewenstein, 1995; Limoges, 1993; Neidhardt, 2002, 2004; Nelkin, 1992, 1995a, 1995b; Peters, 1994, 2000). First, they notice a quantitative increase in science coverage. Even though space exploration and nuclear research have been media topics for a long time (e. g., Nelkin, 1995b, pp. 31–61), they argue that science has become a major media issue only recently. They point out the wide variety of print magazines and TV shows on science (e. g., Long et al., 2001; Milde and Ruhrmann, 2006), the fact that "science sections got bigger" (Clark and Illman, 2006), that it is now typical to see "news about science and technology [...] featured in front page articles" (Nelkin, 1995b, p. 1), and that "[n]ever before such a flurry of images about science has been made public" (Felt et al., 1995, p. 244). Science has turned into a "public issue" and an "object of constant media observation" (Weingart, 2005, p. 28).

Second, scholars posit that there has been a change in the nature of science coverage. They argue that debates on scientific issues have become "diversified" (Maasen, 2002, p. 12) and more "egalitarian" (Weingart, 2005, p. 23). Several authors note that counter-experts and non-scientific actors – from politics, NGOs, the economy, churches, etc. – frequently appear in the media, lobbying for their points of view on scientific issues (e. g., Peters, 1994; van den Daele et al., 1996). Some scholars even believe that scientists themselves are underrepresented or have experienced a loss of authority due to this pluralization of coverage (cf. Gunter et al., 1999, pp. 374–379; Braun et al., 2002, p. 2; Maasen, 2002, p. 4). Consequently, a number of scientific controversies developed in the media, and the public developed "an increasingly critical perception of science and technology" (Felt et al., 1995, p. 17; see also Nelkin, 1995b, p. viii–ix; 1992, p. ix; 1995a, p. 450).

Mediatization as science's response to media attention

The second dimension we wish to explore is the claim that science has become more publicly-oriented. In response to the alleged critical public[3], science has to use the media, some argue, to legitimize its usefulness to society (cf. Gregory and Miller, 1998, pp. 1–8; Limoges, 1993, p. 274; Valiverronen, 2001, p. 44; Weingart, 2003, pp. 118–121) Since the 1980s, science policy institutions have therefore launched and supported multifaceted efforts in science communication (e. g., The Royal Society, 1985, 2000; PUSH-Memorandum, 1999). The main aim of these efforts is to facilitate communication between scientific institutions or individual scientists and the public sphere, specifically the media.

There are a number of indicators for a perceived need to foster media and public attention, most notably the fact that most universities and research institutes have now professional public relations staff to handle media demands (e. g. Peters et al. 2008). Also, media coverage of research findings sometimes precedes their publication in peer-reviewed journals, as was the case in 1989 for cold fusion (Lewenstein, 1995; Bucchi, 1998) and in 2000 for the human genome project (Rödder, 2009a; Nerlich et al., 2002). For emerging fields such as climate research, scientists generate media attention by proactively initiating "catastrophe discourse" (Weingart et al., 2000). Using "promotional metaphors" (Nelkin, 1994), "visible scientists" (Goodell, 1977) try to exploit the media for their own purposes, like ensuring priority for their findings or gaining public attention (Weingart, 2001, p. 245). Furthermore, media coverage also impacts on scientific publications, and has been found to increase the number of citations for scientific articles (e. g. Parthasarathy, 2006; Phillips et al., 1992). For example, after a research article by sociologist Laurel Walum was publicized in the New York Times, she received about 300 letters from colleagues, prompting her to voice concerns about the fact that the media induced a distortion in the level of her peers' attention (Walum, 1975). Martina Franzen (2009) also suggests that editors of science journals anticipate the media's news coverage of potential articles, which influences their decisions about what to publish.

These developments within academic institutions, the publishing world, and in scientists' rhetorical strategies are indicative of structural change in the scientific community. Yet they have hardly been studied in a systematic way.

Empirical findings – particle physics and genome research[4]

Is there mediatized science coverage in the media?

Our first empirical step is to assess whether science coverage shows signs of mediatization as diagnosed by Weingart and others, i. e., whether it has indeed become more extensive and more pluralized. Using a combination of qualitative and quantitative content analysis, we analyzed some 1,500 articles from German broadsheets[5] on two areas of science: particle (or "high energy") physics, a field that aims to determine the existence and characteristics of elementary particles such as neutrinos, and on human genome research, i. e., the multidisciplinary effort to map, sequence, and functionally analyze the human genome, a project carried out by the international Human Genome Project (HGP) and the U.S. company Celera Genomics.[6] We chose these research fields because they represent cost-intensive, large-scale "big science," because both were present in the German research landscape, and because they are of roughly equal scientific relevance among topics in the past fifteen years[7].

The analysis shows, first of all, that mediatization is a gradual phenomenon in scientific disciplines and varies widely between our two cases. Particle physics received very low media coverage: between 1994 and 2003, the newspapers we analyzed only published 141 articles on the topic, approximately 14 articles per year or one per month. Media coverage on neutrino research can therefore not be considered extensive. Furthermore, we found no indicators of pluralization or any kind of controversy. Articles were routinely placed in the science section of the newspapers (72 %), the physicists themselves account for 86 % of all quotations, and only few articles offered an opinion or evaluation on the topic at all (16 %). When an article does make an evaluation, almost all are positive (93 %). Furthermore, journalists interpret the topic with the exclusive use of the scientific frame (100 % of all statements): the media engage in the scientific debates on whether neutrinos have mass, how they pass through matter almost undisturbed, or how they oscillate between "flavors." Almost no non-scientific speakers are represented, and there is no plurality of positions, no ambivalent or critical evaluations, and practically all newspaper articles were written following the publication of a scientific article or other institutional initiative (93 %). In other words, news reporting on particle physics was led by scientific activity. Its content, while similar to expert communication in scientific journals, is simplified for a broader audience, i. e., the coverage "popularizes" science (cf. Hilgartner, 1990).

For the case of human genome research, however, media coverage is quite different: reporting is both highly extensive and pluralized. Between 1994 and 2003 (the same 10-year period as for particle physics) 1,428 articles on human genome research appeared in the two newspapers, ten times the amount for particle physics[8]. Moreover, the coverage shows various indicators of pluralization: First, 79 % of articles do not appear in the science section. In fact, almost one-third of the articles (32 %) are placed in the culture section ("Feuilleton"), which is usually not devoted to biological sciences. Second, the participants in the debate are from different fields. Biologists, being the primary scientific experts on the topic, only account for 40 % of all statements. The other sixty percent represent the following fields: politics (13 %), civil society (such as NGOs, churches, artists, etc. with 10 %), economics (11 %), and the social sciences and arts (10 %). Third, coverage is not exclusively and not even predominantly initiated by genome researchers and their publications, i. e., media reporting does not follow the scientific agenda. Only 38 % of all articles were initiated by (bio)scientific activity, and of these activities, approximately two thirds were not conference papers or publications, but staged media events such as news conferences of scientific institutions. Fourth, evaluations of human genome research, although still largely positive, are significantly less affirmative as compared to particle physics. Almost every second article (48 %) contains an evaluation of the issue, and when analyzing these, ambivalent (36 %) and negative (17 %) evaluations together outweigh positive ones (47 %). Fifth, the exclusive dominance of the scientific interpretation as we saw in reporting on particle physics is much less pronounced in articles on human genome research: while the majority of statements still deals with the scientific and medical importance of the research and its relevance in the wider context of (life) science (64 % of all statements), other frames are also present. The ELSI frame accounts for 19 % of all articles, and discusses the possible discrimination of disabled people or those with a genetic predisposition for a certain disease. The ELSI frame is also concerned with the patenting of genetic data and the use and storage of sequence information.

Human genome research, therefore, is an obvious case of mediatization in that coverage is both extensive and pluralized. In addition to human genome research, numerous other instances of mediatized science coverage are described in recent literature, such as: the cloning of Dolly, the sheep, in Italian (Neresini, 2000) and German media (Weingart, 2006), human cloning in the UK (Holliman, 2004), stem cell research in the US (Nisbet et al., 2003), British (Kitzinger and Williams, 2005) and German (Schäfer, 2009) media, several biotechnology issues in Switzerland (Bonfadelli et al., 2002) and Iceland (Hjorleifsson et al., 2008), breast cancer research in the U.S. (Corbett and Mori, 1999), and the treatment of evolutionary psychology in the British press (Cassidy, 2005). As we can see, specific disciplines, and life sciences in particular, seem to be prone to extensive and pluralized coverage (an aspect that has led some to diagnose a "genohype" in the media: e. g., Holtzman and Marteau, 2000; Fleising, 2001; Caulfield, 2002).

Our longitudinal data also show that mediatized coverage is limited to particular phases. While coverage on human genome research was extensive and pluralized between 2000 and 2001, interest decreased to a lower routine level for the rest of the period under study. Between 1994 and 1999, only a few articles appeared on human genome research (the annual average is fifty). These articles were initiated predominantly by genuine scientific events such as conferences or publications (77 %) and were most often placed in the science section (49 %). Experts, i. e., life scientists, provided commentary 45 % of the time, two-thirds of the

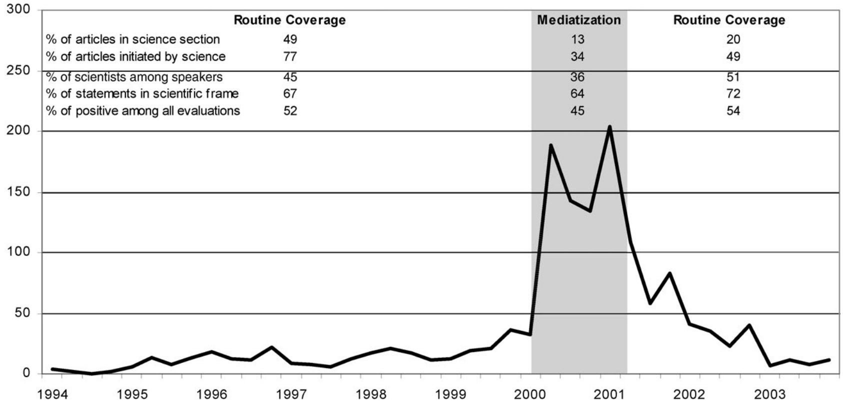

Figure 1. *Media interest over time (numbers of articles per quarter).*

content used the scientific frame, and evaluations, if present, were mostly positive (52 %). Following the mediatized phase, we find a similar pattern from 2001 to 2003 in terms of the quantity and plurality of coverage. These periods make up the majority of time under study and can thus be considered the "routine" phases of coverage. These routine phases differ sharply from the mediatization phase, which began in early 2000 when the scientific rivalry between the publicly-funded international consortium and Celera Genomics sped up. This rivalry began when Celera announced that the company had nearly completed sequencing its genome draft. Increased media interest died out in 2001 after both projects published their respective versions of the genome in scientific journals. During this peak phase, coverage became extensive, with an annual average of more than 600 published articles in the two newspapers. Furthermore, the reporting became pluralized, with almost 90 % of all articles published in non-science sections. Two-thirds of the articles were initiated by non-scientific institutions, almost half of them from political institutions (49 %). Scientific actors only accounted for 36 % of all statements in this phase, and although 64 % of all statements used the scientific frame, it lost some of its prominence. Also, the percentage of positive evaluations sank from 52 to 45 %.

Mediatization therefore follows "mediatization cycles", similar to "issue attention cycles" for other news (cf. Downs, 1972). Although there are only a few longitudinal studies on science coverage so far, several of them confirm these findings by showing cyclical developments in news reporting on scientific issues such as gene therapy (Voss, 2009), plant and human biotechnology (Nisbet and Huge, 2006; Nisbet and Lewenstein, 2002), and space research (Clark and Illman, 2006), as well as for the reporting on diverse science issues in Bulgaria and the UK (Bauer et al., 2006).

Repercussions of media attention on science?

Our content analysis shows that one can distinguish between routine and mediatized phases of coverage. Phases of mediatization are characterized by an increase in coverage and by more pluralistic debates. We will now investigate whether these changes in media coverage trigger repercussions from the scientific community, the consequences of which are unclear for science's institutional and epistemic sides. One could assess these alleged changes empirically by comparing science topics with varying levels of media exposure. We assume, however, that structural changes within the science system will be most visible for those topics with a high level of media interest. This is based on the argument that unusual or "crisis" (Oevermann, 2001; Lüders and Meuser, 1997) situations are most likely to bring about structural change. For these types of crises in science, Bucchi argues that "the contribution of the public discourse to scientific communication can become most evident and therefore amenable to investigation" (1998, p. 15).

We therefore use human genome research as our case study to investigate the hypothesis that scientists and scientific institutions are increasingly looking to the media for their lead. To explore the repercussions of high media visibility, we use in-depth interviews with scientists from the international Human Genome Project (HGP) and from Celera Genomics, which were conducted in Germany, France, Britain and the United States[9].

The interview data confirm the differentiation between routine and mediatized phases during the genome project. The genome researchers described the years 2000 and 2001, the final phase of the genome sequencing, as an "anomaly," "a real exception," and "an extreme case" (several quotes). In their routine relationship with journalists, the interviewees attributed media attention to the life sciences (as compared to particle physics, for example) to its relevance to both science *and* society. And in turn, they saw the publicity of their research as an acceptable circumstance to secure resources and support. They described the relationship between researchers and journalists as active lobbying for the genome field, thus readily adapting to medial, political, and economic demands. The interviewees acknowledged the importance of public relations (PR) professionals at universities and research institutions. Peters et al. (2008) provide evidence that PR professionals prioritize scientific criteria over media standards and that they respect the authority of scientific experts. This attitude goes both ways: genome researchers welcome science PR and outreach activities and recognize their necessity. The interviewees widely perceived PR professionals and most science journalists as accepting scientific expertise and reporting mainly on scientific achievements in a "nice and friendly, factual" way (18:45)[10].

These attitudes changed, however, in the phase characterized by a marked increase in media coverage – a phase described by the researchers as being "thrust into the public eye" (10:65). The interviewees attributed the permanent media coverage from 2000 onwards to the crisis situation of an intense competition between two rival scientific teams to finish the first draft of the human genome. Publicly and privately funded researchers agreed in their assessment that "the stakes were pretty high" (several quotes), both with regard to the appropriate sequencing strategy and to data access policies. The Human Genome Project sequence data are publicly available and accessible to scientific scrutiny, whereas Celera was described by one interviewee as "a big black box of a company with some sound bites coming out at the top. Maybe they can do it faster and cheaper. We really don't know" (8:171). Finishing the genome first was perceived as the main factor that turned genome sequencing into a story "for the seven o'clock news" (5:22).

Under these circumstances, the two companies were not only competing for priority in sequencing the human genome but for the media as well, and their active lobbying turned into a defense strategy to safeguard resources. While the publicly-funded scientists feared a "loss of political support" (11:66), the private company had to maintain a positive public image to ensure the flow of venture capital. "Celera did a very good job at saying it won" (24:42), thereby creating "a big PR problem" for the public project (50:41). Press offices at academic institutions were "no match" (1:72) for the private firm's professional marketing strategy. Consequently, the publicly-funded scientists were almost entirely reactive, and were thus forced to play by the rules of the media game in a number of ways: socially, in that "people were heavily exposed", temporally, in that people had to "improvise", and materially, in that communication became "promotional" in nature (all 11:486).

The genome researchers noticed that their communication changed to a more political style during this phase. "Misinformation" (9:111) and "spinning" (5:368) replaced sound statements, and arguments were substituted by rhetorical strategies. The interviewees also described the consequences of increased media attention for their research practice: funding for a number of small sequencing centers in the United States was cut, the goal of producing a high-quality sequence was omitted for a preliminary draft version, and the project was accelerated to completion two years earlier than previously planned (cf. Collins et al., 1998; Waterston and Sulston, 1998). The scientists justified these changes by saying that the public project, at this point in time, was judged "not scientifically, but commercially and in the media" (10:41). The interviewees broadly acknowledge that, for political reasons, a *PR version of the genome* was presented in June 2000, when publicly and privately funded scientists announced the first draft sequences of the human genome in a joint White House press conference (cf. Rödder, 2009a). The scientists had different assessments of this media event's impact on their research: while some perceived it as a blockade to work in progress, others welcomed the event as a way to return to their quiet scientific work by getting rid of media and political pressure. But everybody agreed on why their public image and the media became so important in that phase: both teams feared a loss of funding.

In this time of mediatization, the genome researchers took cues from the media, rather than being guided by their own agenda and criteria: the PR version of the human genome was presented at a scientifically arbitrary point in time, and the journal *Science* published the Celera data even though they were not yet publicly accessible (Venter et al. 2001). But while this phase was perceived as a "symptom of things that are worth worrying about" (11:362), it was unanimously regarded as an anomaly in the relationship between science and the media. When media, public, and political interest lessened in 2001, research continued. The publicly funded researchers kept sequencing and finally published a high quality genome sequence (International Human Genome Sequencing Consortium, 2004). Celera's attempt to privatize data that were perceived as a basic scientific tool was unsuccessful. In the aftermath of the Human Genome Project, the principle of open access in molecular biology was institutionalized for all kinds of data.

The qualitative data thus support the content analysis, in that the genome researchers do not perceive media interest or their adaptation strategies as steadily increasing phenomena. Both data sets also confirm that mediatization is restricted to a small number of scientists who appear in the media: it is only a small elite of reputable and media-savvy scientists that gets increased media prominence[11].

Conclusion

Drawing on theoretical ideas from the sociology of science, we distinguished and investigated two dimensions of the mediatization of science: changes in science coverage and repercussions of media attention on the science system.

Based on our findings, we believe that mediatization should be considered somewhat differently for science topics.

The data suggest that a routine relation between science and the media should be distinguished from crisis situations, or phases of mediatization. In routine phases, scientific relevance is transformed into news value: Media attention follows the scientific agenda, and scientific reputation is converted into media prominence. The prime examples of this are the instances when the science page of a newspaper paraphrases a scientific article recently published in a leading peer-reviewed journal or a scientist appears in the media as an expert guest or commentator whose knowledge is not called into question. In these cases, the media acknowledge scientific criteria, routines, and knowledge within the scope of their own formats and timeframes. In other words, scientific relevance guides the allocation of media attention in the routine phase. The routine mode of coverage is, still, *popularization*.

In contrast to the routine phase, the relationship between science and the media gets more complex and multifaceted during mediatized phases, as shown for the case of human genome research. Science loses its agenda-building authority, scientifically arbitrary milestones are presented as staged events, and peers debate in the media.

Our data indicate that mediatization of science is a gradual phenomenon that can be specified in temporal, material, and social respects:

- In the *temporal* dimension, media interest is restricted to a limited period of time. In the genome case, media interest was limited to the final phase of draft sequencing in 2000 and early 2001. As shown, this mediatization phase differs from routine coverage phases both preceding and following this phase.
- In the *material* dimension, mediatization applies predominantly to research that can be linked to everyday life. This is especially true for the life sciences. "Big science" and cutting edge research alone, however, do not automatically translate into media attention, as the case of particle physics shows.
- In the *social* dimension, mediatization is restricted to a small percentage of all working scientists in a field. Only a few visible scientists garner more media attention.

Our results suggest that mediatization is rare in science, as evidenced by the fact that the genome case was considered an anomaly. Because we selected this case as a prime example of high media interest, we can draw a more general conclusion with regard to the mediatization thesis: even in the genome case, repercussions, such as changes in scientific communication to a political style, are limited to a certain phase. This supports the notion that media-induced structural change in science, though present, is much less pronounced than mediatization of other parts of society, most notably in politics and sports. Compared to these systems, science's media resistance is rather high, even in the high profile genome case. Major structural change is even more unlikely to occur in less-exposed scientific fields. We still do not know how many of these mediatized fields and phases there are, however, and analyzing and comparing further scientific fields in terms of their mediatization characteristics is an issue for future investigation.

Bionotes

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Notes

1. Authors with different disciplinary backgrounds refer to "mediation" (Altheide and Snow, 1988; Livingstone, 2009), "mediazation" (Thompson, 1995), "mediatization" (Schulz, 2004; Krotz, 2009; Hjarvard, 2008), or "medialization" (Weingart, 1998; Peters et al., 2008; Rödder, 2009a). We wish to foster an interdisciplinary and international discussion and therefore adhere to the use of "mediatization" in this article, despite the tradition in the sociology of science to speak of "media*l*ization" or, in German, "*Medialisierung*".
2. We would like to thank Joanna Schenke, Andreas Schmidt and Inga Schlichting for proof-reading (parts of) the manuscript.
3. While the question of how to define this public is controversial (Neidhardt, 1994), we define public to mean an audience other than scientific peers.
4. The empirical data presented here is based on two studies that focused on the complementary dimensions of mediatization outlined in section 2 (cf. Rödder, 2009b, Schäfer, 2009, 2007).
5. We analyzed the "*Frankfurter Allgemeine Zeitung*" and the "*Süddeutsche Zeitung*", which are the national quality dailies with the largest circulation in Germany (e. g., IVW, 2000). These papers are widely read by elites and journalists (Wilke, 1999, p. 311), and important inter-media agenda setters (Weischenberg, 1995, pp. 190–192), especially for science topics (cf. Haller, 1996). Using their electronic archives, we selected all articles that contained one of several keywords proven valid and effective in a preliminary study (Schäfer, 2007, pp. 77–92). These articles were then analyzed using a qualitative frame analysis. We used a heterogeneous corpus of texts from the media, but also from stakeholders, NGOs, internet discussion fora, etc., to reconstruct and group the basic arguments about the selected scientific fields in so-called "frames" (cf. Benford and Snow, 2000; Scheufele, 1999), which are ideal-type arguments used to interpret certain topics. In this case, we distinguished four basic frames: The *scientific frame*, which includes descriptions of scientific facts, evaluations of the scientific and medical implications of the research, discussions about scientific norms and rights, such as freedom of research, and research funding. The *political frame* refers to the external (political and/or judicial) regulation of science. It also includes assessments of public partici-

pation in such regulation. The *economic frame* consists of both micro-economic aspects, such as the research's impact on companies and businesses, as well as macro-economic aspects, such as impacts on national economies. The *ethical, legal, and social* (ELSI) *frame* includes discussions about science's view of human nature, possible discrimination based on the research, and property and patenting issues. In a second step, these frames were used in a quantitative content analysis to code stakeholders' statements. We also coded information about the various speakers in the articles (name, affiliation, nationality, etc.) as well as their evaluations of the research in question.

6. We also analyzed coverage on stem cell research. Because the results for this research and human genome research were very similar, the findings for this field are omitted here, but can be found in Schäfer (2009).
7. As an indicator of scientific relevance, we used annual rankings from the journal *Science*, in which the editors rank the year's most important science issues. In these lists, particle physics and human genome research have ranked equally high in the past decades. Furthermore, several Nobel prizes were awarded for neutrino research during this time (see Schäfer, 2009, p. 499).
8. Media interest was similarly high in the US, Britain, France, Austria, and Ireland (cf. Gerhards and Schäfer, 2006; O'Mahony and Schäfer, 2005; Rödder, 2009a).
9. Fifty-five scientists were interviewed in total, from Germany (17), France (6), Britain (14) and the United States (18). This number includes high-profile heads of the genome projects, as well as scientists with less or without any media experience. The scientists' self-descriptions were explored using focused expert interviews. This interview design allows the researcher to take his research interest into account without hindering the interviewee's own structures of relevance. The transcripts were analyzed case by case and comparatively, with categories derived both by induction and deduction (cf. Witzel, 2000; Meuser and Nagel, 1991, for details on the methodology and study design, see Rödder, 2009b).
10. We use quotes from the interviews to represent the interviewees' characterizations of the routine and mediatized phases. The first digit represents the number of the interview, the second digit the coded sequence.
11. Moreover, the researchers express a striking ambivalence towards high-profile scientists. This attitude results from conflicting requirements for scientists who try to meet expectations to communicate in the media while adhering to the normative structure of science (Rödder, 2010).

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