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Position Paper

On Designing Communication between the Scientific Community, the Public and the Media

Recommendations in light of
current developments

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On Designing Communication between the Scientific Community, the Public and the Media

Recommendations in light of
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Foreword

Science and journalism are among the essential pillars of a democratic society. This is why Article 5 of the German constitution (Grundgesetz) guarantees freedom of the press and scientific freedom. Despite their necessary mutual independence and their often divergent purposes, both freedoms also fulfil similar functions. They supply policy-makers and society with a diverse array of information that is as reliable as possible, reinforcing the education and knowledge of the population and stimulating democratic discourse. They should also provide a basis for reasoned political, economic and technological decisions.

The academies responsible for this position paper believe that the appropriate exercise of this function is being impaired by a series of developments in the scientific and media systems. For example, the economic conditions in both the media and the scientific community have noticeably changed in recent years. Most universities are suffering from a long-term lack of funding; the science system as a whole is changing amid indicator-based performance incentives and the ensuing competition for attention. The media landscape is also undergoing a profound upheaval, the reasons for which include the digitisation and fragmentation of the media and the resulting economic constraints.

The academies are concerned about the aforementioned development and consider it necessary that the scientific community and the media itself, as well as political decision-makers and society, take a more active role in ensuring the future quality of generally accessible information, including scientific knowledge and its representation in the media.

The present policy paper was compiled by a working group of scientists and journalists. It takes into account the changes in classical media and is an attempt to call attention to the aforementioned challenges. The recommendations expressed here aim to provide food for thought for decision-making authorities and in this way to counter the undesirable developments that have been observed. This subject has not yet been exhausted, and “new media” (web 2.0, social media) requires closer observation.

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1. Summary

Science and journalism are among the essential pillars of a democratic society. Despite their necessary independence from one another and their often divergent purposes, each also fulfils a similar function in supplying policy-makers and society with a diverse array of information that is as reliable as possible, reinforcing the education and knowledge of the population and stimulating democratic discourse. They should also provide a basis for reasoned political, economic and technological decisions. The academies responsible for this position paper are therefore concerned about some of the current developments in the scientific community and the media, and consider it urgently necessary that scientists and journalists themselves, as well as political decision-makers and society, take a more active role in ensuring the future quality of generally accessible information, including scientific knowledge and its representation in the media. In order to counter these undesirable developments and to improve communication among the scientific community, the public and the media in a democratic society, the academies have the following recommendations:

1.1 Recommendations for the scientific community

1. The central committees and administrative levels of all scientific facilities should review their communication strategies with respect to compliance with scientific quality standards and scientific integrity. They should develop ethical principles and quality criteria in collaboration with journalists that will address how to communicate the results of their research to the general public and the mass media.

2. We recommend that science organisations introduce an overarching quality label to indicate trustworthy science communication so as to single out communication to the press that meets the listed criteria.

3. The principle of research integrity and self-criticism by individual scientists should obtain validity and be reinforced in communication with the public and the media. For example, the media's deliberate exaggeration of research results that are not backed up by data or evidence (hype) should be considered a violation of good scientific practice and sanctioned accordingly.

4. Universities and research facilities must focus on their internal performance metrics so that they do not prompt or reward conduct that violates the principles of truthful communication.

1.2 Recommendations for policy-makers and social actors

5. Policy-makers are encouraged to create incentives for university administrators and for the administrators of other research institutions in order to promote integrity in communication (see Recommendations 1. to 4.).

6. The German government and political parties should pay more attention on the whole to ensuring high-quality, independent journalism at both the regional

and national levels, and should promote research into the future and funding of high-quality journalism. Representatives from the media must also be included when formulating preferences for future research into this set of issues.

7. We challenge foundations in Germany to look into increasing their future commitment to the sustainable promotion of high-quality journalism.

8. In schools and teacher training, the rules and mechanics of the process of scientific discovery must be conveyed more strongly.

1.3 Recommendations for the media

9. Publishers, broadcasters, publishing associations, educational facilities and (science) journalists' professional associations are strongly urged to provide funding support to promote the development of quality criteria for reporting on topics in science. In particular, there must be more reinforcement of systematic and continuous training for journalists that will ensure again journalistic quality in all media. It must be apparent to outsiders as well and be required of public-service broadcasters in particular.

10. We recommend that a Science Press Council be established in the mould of the German Press Council (Deutscher Presserat) to assess complaints about unfair and negligent reporting, develop appropriate codes of conduct and censure glaring mistakes.

11. We advocate the establishment of a Science Media Centre in Germany that would support scientific reporting and is currently under debate, on the condition that institutionally such a facility is permanently located with journalism.

12. The mass media, publishing associations and comparable institutions are encouraged to develop common strategies on communicating the role and significance of independent journalism in a democracy. In particular, new funding models should be developed for independent and high-quality knowledge-based journalism, that also include new media.

13. Public-service broadcasters are strongly urged to use their editorial content to markedly reinforce their mandate to inform rather than entertain.

2. The relationship of science and the media to the public in the democratic state

2.1 The imperative of appropriate communication

It is a fundamental principle of a democratically constituted polity that its citizens or their representatives in parliament where applicable, determine basic decisions about the direction of policy and the use of their taxes to do so. The right to information follows from this. In modern representative democracies, the right to participation is structurally transferred to the people's elected representatives. Work on complex matters is frequently passed to expert committees. This increases the people's distance from direct participation even further.

The problem of alienating a large part of the public from being involved in political decisions has contributed to political apathy for some time, as well as demands for more participation and deliberative or even direct democracy; it has become a subject of public debate. This problem is equally relevant for the sciences and for science policy.

On the one hand, it is generally acknowledged that modern societies increasingly depend on science and engineering. This importance of science and engineering is reflected in both the considerable financial appropriations made by the state and the broad scope of science, technology and innovation policy. On the other hand, since the 1970s there has increasingly been an awareness in all industrialised countries that the advancement of scientific knowledge and technological development can bring unintended consequences. These have repeatedly led to public protests and have ultimately driven critics of this development to organise politically. Even so, the mechanics of science and the policy to promote and regulate it seldom receive very much public or media attention, whether because they lie outside the realm of experience of the great majority of people or because they represent a highly specialised subject matter that remains inaccessible to most.

This circumstance is unsatisfying in several respects, and because of it, science and technology policy is often devoid of an accompanying public debate to negotiate its opportunities and risks. The general public thus tends to remain underinformed about matters of science and technology policy. It is true that information alone is not a sufficient condition for appropriate communication, but because of the aforementioned deficits, the public tends to react surprisingly strongly again and again. These reactions are then articulated in the form of hardened discourses that only take place in retrospect and leave no room for compromise, provoking similarly unsympathetic reactions from the opposition side. Some examples are the debates over nuclear energy in the 1970s, the discussions of green genetic engineering in Germany or the current concern over fracking. In a few extreme cases, as a result of polarisation and propensity towards violence, these altercations have even developed into threats to democratic procedure and the rule of law itself. The public's unbiased involvement in discourse related to science and technology policy requires transparent and open communication that is appropriate to the subject, addresses the problems in question, and

actively informs the public about the possible policy options and their risks. It is a fundamental requirement of democratic states and a necessary element of both science and policy.

2.2 The transformation in science communication

Here science communication is understood in the sense of research facilities, universities, and other scientific organisations reliably and actively informing the public of advances in scientific knowledge and their social and political implications. This type of communication has been starkly transformed in recent years. The decisive changes can be attributed on the one hand to increased public expectations (focused by NGOs and the media) of appropriate instruction. But policy-makers have also since developed a greater sensitivity to these demands for transparency. In addition, science itself has also become more open to society, and scientists have discovered the value of communicating their results in a comprehensible way. With at times great enthusiasm and the dedication to match, individual researchers or entire institutions are today turning specifically to laypeople in "science slams", at science festivals, lecture programmes for children, and numerous cooperation projects with schools. Science organisations have also been promoting this involvement through measures such as the establishment of a "Communicator Award" by the German Research Foundation (Deutsche Forschungsgemeinschaft, DFG).

In the process, the formats of science communication have undergone gradual but important changes. The science-driven formats that first appeared in Anglo-American publications in the 1980s operated under the label of "Public Understanding of Science" (PUS). They aimed both to attract young recruits into science and to increase the acceptance of science and engineering in society, beginning with the assumption that this could be achieved practically automatically through better education in and information about the natural sciences. The formats were shifted in the face of criticism of this basic assumption as paternalistic, as well as the factual rebuttal of the idea that better understanding would necessarily lead to more acceptance. (At its root, the shift was one from unilateral to reciprocal communication.) Today, Germany's *Wissenschaft im Dialog* and *Wissenschaftsjahre* and England's *Public Engagement with Science and Technology* are not only the names, but also the programmes of the corresponding organisational forms.

However, it has not yet been ascertained whether the purported dialogue or "public engagement" is actually taking place. In point of fact, even today we can see only a rudimentary culture of dialogue directed towards mutual learning. In particular, the publicity-centred advertising formats developed by PR firms do not achieve the goal of reciprocal science communication that will intensify participation. These are usually directed to an unspecified mass audience and are meant to increase its willingness to accept something.

For many decades, the classic print, radio, and television media has played a central and important role in informing the public about science and how to assess it. However, the character of science journalism has changed, in part because the media is subject to great economic pressure. This has not been without its consequences for science reporting (see 2.4), which is supposed to provide neutral representation, contextualisation, and critical scrutiny.

Meanwhile, induced by new media, a completely new dimension of communication between the public and the sciences has arisen: science and its institutions are now directly accessible to everyone

through the Internet, and they have also become the object of blogs and other social media. What this means is that members of spontaneously emerging networks on various Internet platforms can exchange views on specific scientific subjects independently from the media reporting produced by an editorial desk and can also communicate directly with the scientific community about these subjects. For example, citizens' initiatives have recently issued animated calls for dialogue on controversial topics. Because of their occasionally broad effect, these represent a unique challenge to the scientific community and as a result demand new forms of legitimation and justification. Although the factual influence of new media on science in particular has yet to be extensively investigated, online plagiarism checkers and sites such as *retraction watch* that patrol violations of the rules of good scientific practice indicate the potential effects these new forms of communication could have on science. With the impact of all of these developments, one can assume that a certain segment of the public has become more interested in and is paying more attention to science, the implications of new findings, and the political consequences with respect to regulations. However, this does not in any way signify greater or even unconditional approval. To the contrary, trust in institutions on the whole has decreased, including science.[1]

In addition, it is apparent that less trust is being placed in scientific experts. This state of affairs can be traced back to the fact that research results are frequently communicated as being certain and therefore unquestionable (such as the case of Germany's "dying" forests[2]), or that the expert opinions of particular interest groups are accommodated with one-sided arguments or interpretations of research results (e.g., by sowing doubts about the connection between smoking and the development of cancer). Moreover, citizens today can use the Internet to easily get their information from a multitude of accessible sources, which not infrequently makes them sceptical of experts. This is true both with respect to public discourse about scientific subjects (e.g., stem-cell research, climate change,[3] or genetically modified foodstuffs) and as regards individual contact with experts (the doctor-patient relationship is a clear example of this).

These developments are being reinforced by the fact that the way in which the public is informed about scientific issues has likewise undergone fundamental changes. In the 1980s, scientists and science journalists still primarily communicated in the style of popularization of knowledge that was certified by science and therefore considered certain (consolidated). Not until after this period did reporters begin moving ever closer to cutting-edge research, focusing on current scientific and socio-political debates in which the science in question was more uncertain and was disputed among the members of the relevant expert communities themselves. Because of this the public's perception of the authority of scientific experts has likewise changed fundamentally. Instead of the scientist, whose judgement had often been considered final, and who stood in for the entire relevant community of experts, the impression has set in that there is a certain arbitrariness to expert judgement, a possible connection to political positions and/or economic interests, and above all an air of uncertainty and of

1 Gauchat, G. (2012): Politicization of Science in the Public Sphere: A Study of Public Trust in the United States, 1974 to 2010. *American Sociological Review*, 77(2), 167-187: Weingart, P., Lentseh, J. (2008): *Wissen – Beraten – Entscheiden. Form und Funktion wissenschaftlicher Politikberatung in Deutschland*. Weilerswist: Velbrück, 14: Power, M. (1999): *The Audit Society: Rituals of Verification*. Oxford: Oxford University Press.

2 Metzger, B. and Wagner, R.: Der Fall Waldsterben in Deutschland. (expert opinion for the working group).

3 Schulz, P.: Was haben der Diskurs zum Klimawandel und der Diskurs über die Evolutionstheorie gemein? (expert opinion for the working group).

being provisional. That scientists themselves have founded companies in innovative engineering fields, substantially damaging their neutrality on these subjects, only adds to this effect. This development is striking in that at the moment, because the public and the scientific community seem to be coming closer to one another thanks to the intensified availability of information, the uncertainty of science and the fragility of expert judgements have become more readily identifiable and are also being communicated more clearly. The scientific community has thus suffered a considerable loss in the privileged role and authority it was previously conceded.

2.3 Constitutive communication problems of science

The at least partial loss of democratic legitimacy (in the sense of public approval of the sciences) is severe because science today is allocated a special function in democracy. Ideally, in modern societies it is an institutional guarantor of the appropriateness of political decisions. The foundation of the legitimacy of democratic political systems, besides voting and the delegation of power through voting, is a rationality that rests on appropriateness rather than politically imperative calculations.[4] The danger of a break down in communication between science on the one hand and the public, policy-makers, and the media on the other, however, is large. The increasingly experimentally created experiential worlds and the special languages for dealing with them that have developed in the sciences have made possible spectacular advances in knowledge. As far as their connection to the everyday world and its intelligibility, however, they continually increase the distance between the scientific community and the society that surrounds it – between experts, who themselves are differentiated from one another, and their lay audience. Some of these scientific findings have simultaneously had serious implications for the value systems in society and/or institutions (e.g., should genetic diagnosis of embryos be allowed? Could the legal construct of responsible decision-making become void because of new discoveries in psychology and brain research?). What is more, both the scientific community and the media must answer for the way in which reporting has become simplified.

One outstanding example of this is the reduction of complex issues to simple numbers (see the discussion over the PISA rankings), which in public debate are then assumed to be objective without any attention to the measuring problem lurking behind them. The problem of communication becoming disrupted or even threatening to break down continues to worsen. This is even more true if we look more closely at the recent changes that have occurred in science and in the media primarily responsible for that communication.

2.4 Changes to the systems of science and the media

Both the systems of science and the mass media are currently undergoing the greatest revolutions in their recent history, which we can define as “economisation” and “medialisation”. This especially pertains to the various structures for funding, communication, and quality assurance, some in similar ways and others differently. On the one hand, these changes offer opportunities to improve communication to the public and to policy-makers about science, but on the other they also carry substantial risks to how the normative functions (including those enumerated in the German constitution) will be carried out in the future.

4 Schmidt-Aßmann, E. (2008): Verfassungsrechtliche Rahmenbedingungen wissenschaftlicher Politikberatung: Demokratische und rechtsstaatliche Rationalität, 19. In: Präsident der Berlin-Brandenburgischen Akademie der Wissenschaften (Ed.) (2008): *Leitlinien Politikberatung*. Berlin, 19-31.

2.4.1 The science system

The especially profound changes in the science system are primarily related to how the natural sciences and engineering in particular are being more closely integrated into the process of creating economic value. The relevant branches of science are an integral element of the various national – and international – systems of innovation. This aspect of economisation is expressed for example in the share of research and development that is privately funded, which in Germany has been at over 60 per cent since 1989. This development is not without its effects on the organisation of the sciences, first and foremost on the core institution of the university. Universities are subject to the regime of New Public Management (NPM).[5] This second aspect of economisation requires that universities be run like corporations and in their strategies must follow the logic of the business market (acquisition of external funding) and those of artificially created quasi-markets. In order to be allotted material resources, both universities and organisations (as well as scientists) must submit to international comparisons in the form of rankings and are evaluated according to quantifiable indicators (albeit only in certain segments, primarily medicine and the natural and economic sciences). Having been massively intensified through rankings and financial dependence, the competition among universities motivates them to differentiate themselves from one another on the basis of their image (encouraged by policy and by incentive programmes such as excellence initiatives, among other things) and to advertise themselves to the public. At the same time, the unequal perception of rankings and other indicators of the various disciplines and departments trigger further tensions within the university as an institution. Analogous to this, salary differentials and performance agreements motivate scientists to publish their research results where they can be seen all over the world and to communicate these to a broader public *through the mass media*.

Communication with the general public ("outreach") is often included in evaluation procedures. In principle, this answers to an imperative of public accountability and fosters a scientific responsibility to the public at the institutional level. But such responsibility can become distorted if, for the sake of their reputation, the scientists involved wish to communicate only the advantages and opportunities of their research, while leaving out the implications and risks for society.[6]

The conversion of the science system to NPM has caused universities to re-orient their behaviour and has fostered non-university research facilities. Especially noteworthy is the interest in public attention as a means of legitimizing the allocation of public resources and, increasingly, money raised from private research funds. To be sure, the concentration on competition has contributed to individuation and quality assurance in research. But it has its dark side: such competition favours communicative behaviour that is motivated by self-interest. Universities and research facilities have expanded their press offices into professional PR departments. Their self-promotion comes at the expense of prioritising the objective representation of science.[7]

5 Bogumil, J. et al.: Zwischen Selbstverwaltungs- und Managementmodell. Umsetzungsstand und Bewertungen der neuen Steuerungsinstrumente in deutschen Universitäten, in: Grande, E., Jansen, D., Jarren, O., Rip, A., Schimank, U., Weingart, P. (Ed.) (2013): Neue Governance der Wissenschaft. Reorganisation – externe Anforderungen – Medialisierung. Bielefeld: Transcript, 49-72.

6 Rödder, S.: Die Rolle sichtbarer Wissenschaftler in der Wissenschaftskommunikation. (expert opinion for the working group); Kohring, M., Marcinkowski, F., Lindner, C., Karis, S. (2013): Media Orientation of University Decision Makers and the Executive Influence of Public Relations. Public Relations Review, 39 (3), 171-177.

7 Peters, H. P., Brossard, D., De Cheveigné, S., Dunwoody, S., Kallfass, M., Miller, S., Tsuchida, S. (2008): Interactions with the mass media. Science 321.5886: 204; Marcinkowski, F., Kohring, M., Friedrichsmeier, A., Fürst, S. (2013): Neue Governance und die Öffentlichkeit der Hochschulen. In: Grande, E., Jansen, D., Jarren, O., Rip, A., Schimank, U., Weingart, P. (Ed.) (2013): Neue Governance der Wissenschaft. Reorganisation, externe Anforderungen, Medialisierung. Bielefeld: Transcript, 257-288.

Scientists must increasingly communicate the results of their research in as media-savvy a way as possible. Since in this manner they are fundamentally complying with the democratic mandate to report science, scientists' increased willingness to engage in communication should be expressly welcomed. Because of increased competition, however, this can also result in exaggeration, the publication of as-yet-unverified research results and, in extreme cases, the falsification of data or other violations of the rules of good scientific practice. It also blurs the line between communication and marketing, and press offices frequently serve the cause of promotion rather than of imparting scientific information, or at least are perceived that way by the public.

Orienting science communication towards a mass audience (medialisation) sometimes even includes the sources of science communication themselves. The editorial strategies of influential journals such as *Nature* and *Science* are similar to those of the mass media.[8] Because the profit-oriented organisations that facilitate publications are fighting for the public's attention, they no longer select their contributions based exclusively on scientific criteria, but increasingly also for their newsworthiness with the media and the public. One demonstrable effect is the selection of topics that can be expected to generate broad interest ('dinosaurs are always a good bet'). Since such journals also have a high impact factor, publications in them are ranked more highly in evaluations and increase one's scientific reputation.

Investigation into the specific effects of this medialisation of science communication on science itself is just beginning. On the one hand, we should welcome the increase in attention to science's function in society that is occurring because of its dissemination to a mass-media audience. On the other, it is starting to become apparent that the focus in expert science communication on mass-media attention can lead to problems in internal quality assurance and thus in credibility. At the same time, even renowned scientific journals are facing increasing pressures of competition because of low-cost review models from the open-access camp. The effects of this pressure on credibility and perceived expertise have not yet become apparent. But a gathering crisis in the journal system (along with the media crisis described in the following section) could also threaten the quality control mechanisms within the scientific community.

2.4.2 The media system and science journalism

No less severe than the changes in the science system are the changes in the media system. Here we first must differentiate between general developments in the mass media as a whole and special developments in science journalism as a substructure within the media system.

For approximately ten years, there have been various debates about different aspects of the media crisis that began with the establishment of the Internet in the latter half of the 1990s. Only recently has the extent of this crisis slowly begun to penetrate the public consciousness. The striking term "media crisis", in turn, should be differentiated into a crisis of the revenue model (decline in advertising proceeds as well as media users' decreasing willingness to pay because of free content online), a (possible) crisis in audience interest in generally growing, but also increasingly fragmented media offerings, and a crisis in journalistic quality amid the more difficult working conditions for journalists that are a result of the economic pressure.

The dynamics of these developments seem all the more remarkable if we observe how they began, some of them not even fifteen years ago: as late as the 1990s,

8 Franzen, M.: Medialisierungstendenzen im deutschen Wissenschaftssystem. (expert opinion for the working group).

regional and national publishing houses were seeing returns of up to 40 per cent. In many places, print runs were as strong as advertising orders. Public-service broadcasters could also boast a broad scope, thanks to a wide variety of programs. At least in principle, the system therefore had sufficient funds to facilitate quality journalism. But this was often used to expand what was on offer, in order to attract more advertisers, rather than to deepen quality.

The fact that quality was not expanded with any uniformity at that time, especially in science reporting, may be due on the one hand to the fundamental complexity of the subject and on the other to the fear on the part of some editorial boards that there was no wide readership to be gained here, unlike with news on sport, local issues, and often also politics. We can thus assume that another reason for the frequent deficits in science reporting, and an important one, is the tradition and structure of the media itself.

For example, for a long time subjects such as engineering and the natural sciences have had a place in newspapers only in exceptional cases, to say nothing of a specialised editor or reporting desk, such that even in 1990, science was considered last-minute content.[9]

Between the latter half of the 1990s and the first years of the new century, however, science journalism in Germany nonetheless experienced an upswing that likely had no international precedent. Private broadcasters discovered that science does not drive away viewers, and public-service broadcasters followed the same trend. The great debates over bioscience policy (embryonic stem cells,[10] clones, and the Human Genome Project) and those over the climate were likely key elements here, as well as the tendency for leading media outlets to copy one another. In the print sector, large newspapers continue to set the tone in influencing online offerings and television reporting today, and training for journalists is still oriented towards the newspaper model. The biology supplement of the *Frankfurter Allgemeine* (FAZ) newspaper prompted imitations by other editors who had previously avoided science; mutual inspiration came from extensions to publishing lines (e.g., GEO, Spektrum) and the establishment of new journals (e.g., ZeitWissen, SZWissen). Even regional media reacted to an audience interest in science topics (some of it anticipated and some of it shown in reader surveys) by setting up specialised science, medicine, and/or engineering desks, or at least by hiring individual science editors.

At least in leading print media, this was accompanied by a redoubled disengagement from the "paradigm of popular science"[11] in favour of modelling it on a more professional science journalism that adopted more of the broadly accepted criticism and monitoring functions of general (political) journalism.

The rise of science journalism came to an abrupt end in many places, however, with the crisis in the media system. It was precisely those more recent and less established smaller desks that were often the first to fall victim to these cost-saving measures, regardless of the actual demand for these topics among consumers. The fragmentation of the media landscape by the new media and free online sources facilitated subjects that continue to promise particularly broad reach, most notably scandals, disasters and crime, sport, celebrities and other entertainment. Sector-specific offers such as science reporting have come under increasing pressure,

9 Hömberg, W. (1989): Das verspätete Ressort: die Situation des Wissenschaftsjournalismus. Konstanz: Universitätsverlag Konstanz.

10 See Schönbauer, T.: Der Fall Stammzellen.(expert opinion for the working group).

11 For criticism see Kohring, M. (1997): Die Funktion des Wissenschaftsjournalismus. Opladen:Westdeutscher Verlag.

not least because their comparatively unfavourable (search) income to expense ratio dictates that they must confront specific economic challenges. It is precisely freelance science journalists for whom this becomes a matter of survival and leads to the risk of increasingly mixing PR with journalism. If we take the internal media analysis by science organisations as a basis, we can conservatively assume that more than one in ten press releases from these institutions is taken up practically wholesale by editors in the mass media – not least because of their aggravated personal and structural situation.

Within editorial offices, one logical result of the economic pressure is a trend towards re-orienting science journalism back toward prioritising popular science (for its increased mass effect). Popular formats also allow private broadcasters to tap into target audiences with little connection to science: science, technology and especially medicine continue to be of great interest to many consumers. This is particularly attractive for media entities when they can cover useful topics such as nutrition, health and technology to inform or even purely to entertain. In this context, we could partly even speak of a renaissance of wonder in science journalism ("Gee-Whiz!"[12]). Important scientific topics that are more unwieldy for the media (including the competent critical observation of the science system and science policy) often appear in a background role as compared to more mainstream subjects – excepting a few leading media sources. This reporting bias in science journalism is further encouraged by the way in which many science institutions present themselves. Developing in-house marketing products that use journalistic leads (in both new and traditional distribution channels, such as "research magazines"), they bypass journalism as an intermediary and source of criticism and occasionally seek out direct competition with the mass media's offerings for a broad consumer base. These articles may be perceived by a lay public to be neutral, precisely because of their formal similarity to those independent media products, but their source and purpose means that they are not and thus are misleading consumers.

2.5 Synthesis

Looking at the developments outlined above together, the result is a paradoxical situation: The crisis of the mass media's and science journalism's *capacity* for competent criticism, goes hand in hand with the *necessity* of increased monitoring and external observation in parts of science itself. Martin Bauer, the editor of the journal *Public Understanding of Science,* put it this way: "When independent science journalism is most needed, its economic basis is eroding."[13] Competitive elements in science do not inevitably lead to a failure to comply with scientific standards. But the more that science abandons its practices that – ideal-typically formulated – are committed to exclusively scientific standards, the more it increasingly subjects itself to pressures of the laws of economics and tougher institutional competition, the greater the apparent necessity of observation and public criticism (monitoring in the watchdog sense) through competent and critical science journalism, in both functional and normative respects.[14] With the rise of new

12 Jerome, F. (1986): Gee Whiz! Is That All There Is? In: Friedman, S. M., Dunwoody, S., Rogers, C. L. (Eds.): Scientists and Journalists: Reporting Science as News (AAAS Issues in Science and Technology Series). New York: The Free Press, 147-154.

13 Bauer, M. W. (2013): The Knowledge Society Favours Science Communication, but Puts Science Journalism into the Clinch. In: Baranger, P., Schiele, B. (Eds.) (2013): Science Communication Today. International perspectives, Issues and Strategies, Paris: CNRS Editions.

14 Blattmann, H., Jarren, o., Schnabel, U., Weingart, P. and Wormer, H.: Kontrollfunktion der Medien gegenüber der Wissenschaft? (expert opinion for the working group). Butler, L. (2010): Impacts of Performance-Based Research Funding Systems: A Review of the Concerns and the Evidence. Presentation to OECD-Norway Workshop on Performance-Based Funding for Public Research in Tertiary Education Institutions Paris (Vol. 21).

media and the at least theoretical possibility of direct-to-consumer communication, a trend can also be observed in science and its institutions towards mixing science journalism with science PR.

For this reason and from a normative perspective, a tendency to equate science PR and science journalism should be considered a serious quality deficiency with respect to supplying the public with the most independent information possible. It is also doubtful as to how far an attempt by scientific institutions to renounce the more far-reaching science journalism altogether to directly communicate science to society at large (including less educated segments) would make any sense economically and in terms of content. There is also the question of how and whether this new intensity in communication is still in line with the actual duties of research institutions.

Conversely, if science journalism is to have added value in its communicative and critical function compared to science that can communicate directly, quality journalism is needed, and this can only be ensured with sufficient staff, more professionalisation, further development of quality standards[15] and the active communication of these, and guaranteed funding.[16] New media provides an interesting complement to the existing structures, but it cannot replace them completely. Without new funding models, without requiring at least temporary or transitional support from policy-makers and/or foundations, or even from the science, many classic forms of quality media (especially print) will cease to exist in their current form in the foreseeable future.

Such support of the mass media as would ensure its independence, however, would have far-reaching positive effects on supplying policy-makers and the general public with high-quality information from the scientific community and would counteract the loss of at least basic scientific literacy in society.

15 Criteria along the lines of media-doktor.de and its trial "PR Watch" or the Royal Society (http://www.sirc.org/publik/revised_guidelines.pdfbttp://www.sirc.org/public / revised_guidelines.pdf) could be a starting point for this. See also: Arnold, K. (2008): Qualität im Journalismus – ein integratives Konzept. Publizistik 53(4), 488-508.

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3. Recommendations for the future design of communication between the scientific community and the public in light of current developments

In order to ensure communication between the scientific community, the public and the media in a democratic society and to counter the aforementioned undesirable developments, the academies have the following recommendations.

3.1 Recommendations for the scientific community

The basis of a relationship of trust between the citizens of a democratic polity and the institutions of the scientific community and their experts is the responsible, truthful and unselfish communication of scientific findings to the public. One of the reasons that trust in experts has partially eroded is because science has taken on forms of communication that use the language and techniques of marketing, public relations and the advertising industry. These forms should therefore be avoided, and those chosen should be argumentative and reflective criticism that is commensurate to science and suited to re-establishing trust when the communication and discussion of scientific content is at stake.

1. The central committees and administrative levels of all scientific facilities should review their communication strategies with respect to compliance with scientific quality standards and scientific integrity (argumentative, deliberative, evidence-based). Analogous to ensuring good practice in science, it is important to ensure the development of good practice in science communication. The use of institutional public relations communication formats by universities and research facilities should always be clearly marked as such.

At the same time, we challenge them to develop ethical principles in tandem with scientists and journalists (e.g., commitment to act as honest brokers by being true to the facts, gaining access to all researchers, and avoiding media partnerships) as well as quality criteria for communicating their research results to the general public and the mass media. One example of this could be subparagraph 14 of the German Press Code on the communication of medical research, which asks that sensational or anticipatory reporting be avoided. More clues come from the evaluation criteria for science reporting, as have already been drafted for medical and environmental reporting (see media doctorate from TU Dortmund University).

2. We recommend that scientific organisations introduce a comprehensive quality label for trustworthy science communication to recognise institutional public relations work that falls under the above criteria. This should be done in collaboration with the relevant organisations in this field, such as *Wissenschaft im Dialog* (WiD) and *Informationsdienst-Wissenschaft* (idw). The idw should condition institutional membership on compliance with the standards mentioned here.

The first step, for example at the annual meeting of press spokespersons for the idw member institutions, should be to discuss the subject matter. Criteria

for the idw prize given each year for the "best press release of the year" would likewise have to conform to this perspective.

As an accompanying measure, the academies could organise an "academies prize for fair and objective science communication" open to all scientific institutions in Germany. The formulation of the criteria for prizes of this type would take into account the various current research findings about science communication.

3. The principle of research integrity and self-criticism by individual scientists should also be reinforced in public relations work to give it more validity with the public and the media. The deliberate media exaggeration of research results that are not backed up by data or evidence (hype) and violate the principles of truthful communication within the sciences must be considered a violation of good scientific practice and sanctioned accordingly. A corresponding norm should be incorporated into the relevant codes of conduct (DFG, MPG). The same goes for the concealment of crucial uncertainties in results, gaps in data, methodological problems and justified objections, and other circumstances that make it clear that the results should be classified as provisional or uncertain. Sensitisation to such violations should begin as part of doctoral training and should be combined with communication of the rules of good scientific practice.

4. Universities and research facilities must strengthen their internal performance metrics so that they do not prompt or reward conduct that violates the principles of truthful communication. This especially holds true for the uncritical use of bibliometric indicators in promotions, appointments and performance-related pay schemes. In addition, the DFG, the German Council of Science and Humanities, and the responsible regional ministries are called upon to redesign the performance measures that were introduced, in order to prevent undesired negative consequences.

3.2 Recommendations for policy-makers and society

Policy influences the quality of science communication in multiple ways. For one, it (in the form of the federal and regional governments) determines the framework conditions for science as a whole and for science communication in particular. In the realm of communication, this is especially true for the creation of performance incentives and for special subsidies that preference the deployment of these (see excellence initiatives). This introduction of "quasi markets" into the scientific system has for some time been causing changes in communicative behaviour, in scientists, and in universities and research facilities as well that can generally be described as an increased orientation towards what will garner attention in the media.

Policy (in science) has thus contributed to reinforcing a competition for attention where money from the advertising industry is the deciding factor.

Policy-makers also solicit scientific advice. They sometimes have expectations for unambiguous recommendations for action, that the scientific community neither can nor should provide. This carries the risk that scientific advice will be instrumentalised for political goals, whether it is policy decisions being legitimised, controversies within the sciences being exploited, or overdue political decisions being prevented. The central function of scientific advice, by contrast, is to provide possible options for action along with their associated risks and uncertainties.

There is still room to expand the role of non-state actors in promoting science journalism in Germany, especially foundations: sustainable foundation

funding for journalism in this country is underdeveloped in comparison to the United States. In the past, individual foundations (such as the Robert Bosch Stiftung and Bertelsmann Stiftung) have distinguished themselves with limited-duration incentive programmes for initial and continuing education for science journalists. But sustainable funding models for high-quality science reporting are still scarce today. This may also be because of widespread scepticism in the media industry about journalism funded by foundations. Since funding quality journalism from various sources could most likely only be achieved piecemeal, models of least partial financing of quality media and individual journalists by foundations will become increasingly important in the future.

5. Policy-makers are encouraged to create incentives for university administrators and for the administrators of other research institutions in order to promote integrity in communication (see Recommendations 1. to 4.). Falling into this category would be public prizes for especially successful communication concepts, special funding for the scientific evaluation of communication concepts and their effects, and subsidies for continuing education in science for communication experts and continuing education in communication for subject experts, as well as the creation of a special quality label to be given on the basis of proposals from an independent jury.

6. The government and political parties in Germany should pay more attention to ensuring high-quality, independent journalism at both the regional and national levels. Appropriate measures (such as tax benefits or charitable models) should be developed in cooperation with representatives from publishing houses, broadcasters, journalists, and their respective associations, as well as the scientific community, in order to ensure quality in independent journalism and appropriate reporting on science and research. When it comes to broadcasting mandates, the councils of public-service broadcasters should focus more intensely on emphasising spending on information, education, and knowledge programming over entertainment. Representatives from the scientific community should be given greater weight on broadcasting councils.

Policy-makers should promote research into the future and funding of high-quality journalism that strengthens the skills of journalists, especially with regard to science.

We also recommend including representatives from the media when formulating preferences for future research into this set of issues. In addition, research into policy control mechanisms should be more strongly encouraged within the scientific system in order to further clarify their unintended effects on communication behaviour. This task can be assigned beyond the organisations for research funding themselves: it could be allocated to the member institutions of the BMBF-sponsored Competence Centre for Bibliometrics, for example, or as part of the corresponding new programme-directed lines of funding or in the field of departmental research.

7. We challenge foundations in Germany to look into committing to the sustainable promotion of high-quality journalism in the future, especially those foundations whose bylaws dictate that they strengthen democratic structures, as well as those that are dedicated to strengthening education and science, research, and technology in Germany. We recommend establishing a working group of representatives from foundations, the media, business and science (including press offices in the scientific community) with the aim of working out the models, possible conditions, limitations and risks of a journalism in Germa-

ny that is more strongly funded by foundations but independent nonetheless.

8. In schools and teacher training, the rules and mechanics of the process of scientific discovery must be communicated more strongly, and must bring about an understanding that knowledge is provisional and ever-changing. In the same way, the mechanics of the media system should be taught and reflective media competency encouraged; in particular, the differences between independent journalism and PR communication should be made clear.

3.3 Recommendations for the media

According to reader interest research, topics in science, medicine and technology are a promising area for future reporting within the mass media. Increasingly, this reporting no longer takes place solely through dedicated editorial desks or specific science communication formats, but also penetrates a series of other departments. It is precisely the general-purpose editorial departments of many media, however (current events, news, etc.) that have an overall deficit of editors with training in science and especially the natural sciences; even the large newsrooms of public-service broadcasters sometimes do not have a single editor with the necessary basic knowledge of science, medicine or engineering. Overall, editorial departments (including most editors-in-chief) that do not specialise in science have a very limited understanding of scientific work and the structures of research.

Even in the age of so-called new media, independent journalism remains an indispensable component of a democratic society. But certain quality standards in reporting are required for it to have a working informational, analytical and critical function in relation to policy and other social subsystems (e.g., science and the economy). The academies are committed to the role of public-service media in ensuring the basic provision of journalism across the board – provided that these media have a profile that is suited to doing so.

From an economic perspective, too, journalistic quality is a key factor in securing the future of the mass media as well as the large specialist media. Only if the media offers potential customers added value in terms of information that is freely accessible from sources such as the Internet or social networks will there continue to be a broad willingness to pay for this increase in quality. The quality of information provision in general and of science reporting in particular ultimately depends closely on the state of the media as a whole. Despite or because of economic pressure brought on by the crisis in previous revenue models, the media must focus even more on journalistic quality of its product. This includes also tapping into innovative new fields such as data journalism or the sector of participatory journalism and new media.

In journalism itself, the importance of having as independent a media as possible and of communicating the necessity of professional quality standards for supplying the general public with reliable information has previously been neglected for long stretches. Instead, the debate over the future of the media seems in the media itself to often be influenced by the particular interests of individual publishers or broadcasters. One crucial building block in ensuring the future of the media would be for all media operators to collectively communicate and sustainably convey to the public the core importance of journalism. This also includes enhancing the joint development of new funding and revenue models.

9. Publishers and broadcasters, educational facilities and (science) journalists' professional associations should use their

content and provide funding support to promote the development of quality criteria for coverage of topics in science. This includes the further development of technical and ethical standards for research (such as transparency rules) and recommendations for initial and further training, particularly for editorial departments and journalists that do not specialise in science. There must be more reinforcement of systematic and steady training for journalists, both at and below the professional level, that will ensure journalistic quality in all media. It must be apparent to outsiders as well and be required of public-service broadcasters in particular.

10. We recommend the establishment of a Science Press Council in the mould of the German Press Council or directly connected to it that would assess complaints about unfair or negligent reporting, censure glaring mistakes, and develop appropriate codes of conduct. Editors-in-chief and general administrators should also belong to the Science Press Council, as should specialised science journalists, representatives of press offices in the scientific community, and scientists from various disciplines.

11. We advocate the establishment of a Science Media Centre in Germany, as initiated by the German Science Journalists' Association (WPK), to support the mass media in covering science. Of particular importance is that – unlike in the UK, for example – the institutional aspects of such a facility are centred permanently not on science PR, but on journalism. In this vein, a model featuring cooperation between science journalists' associations and news agencies (e.g., dpa) would appear to be particularly worthy of consideration.

12. We recommend that the mass media, publishers' associations and similar institutions develop joint strategies to communicate the role and importance of independent journalism in a democracy. In particular, new funding models for independent and high-quality knowledge-based journalism should be developed, including for new media. Together with committed bloggers and other representatives from these new media sectors, models for quality and self-monitoring should be developed with an eye towards fairness, as have evolved for high-quality journalism over many decades. These should be established through relevant professional standards, up to and including case law.

13. Public-service broadcasters are funded through licence fees and as such are not subject to the constraints of the media market. They are therefore strongly urged to use their editorial content to markedly reinforce their mandate to inform rather than to entertain. The resources saved from the entertainment sector should not least be put towards higher pay for freelance journalists who carry out intensive and/or investigative research. It should be further examined what content on the Internet from educational and scientific fields could be made more accessible and available for a longer period than the applicable restrictions previously allowed.

4. Methodology

4.1 Participants in the working group

Working group

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Heidi Blattmann	Herrliberg (Switzerland)
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Prof. Dr. Alfred Pühler	Universität Bielefeld
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Ulrich Schnabel	Die ZEIT
Prof. Dr. Pirmin Stekeler-Weithofer	Universität Leipzig
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Dr. Christian Anton	Nationale Akademie der Wissenschaften Leopoldina

Research associate

Patricia Schulz	Universität Bielefeld

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Dr. Marc-Denis Weitze	acatech office

Experts

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Prof. Dr. Klaus Fiedler	Ruprecht-Karls-Universität Heidelberg
Prof. Dr. Armin Grunwald	Karlsruher Institut für Technologie (KIT)
Prof. Dr. Peter Graf Kielmansegg	Universität Mannheim
Prof. Dr. Georg Ruhrmann	Friedrich-Schiller-Universität Jena
Christian Schwägerl	Freelance journalist
Dr. Dagmar Simon	Wissenschaftszentrum Berlin für Sozialforschung (WZB)

4.2 Methodology and project history

The project "On the Relationship of Science, the public and the media" was approved at the meeting of the Standing Committee of the National Academy of Sciences Leopoldina on 16 September 2011 at the suggestion of acatech – National Academy of Science and Engineering and the Berlin-Brandenburg Academy of Sciences (BBAW).

Two meetings of the working group took place in conjunction with expert hearings, in which experts from various levels of the hierarchy in science and the media were consulted by interviewers ranging from postdocs to institute directors and from freelance editors to general administrators.

Experts consulted on 20 June 2012

Prof. Dr. Achim Brauer	Deutsches GeoForschungsZentrum Potsdam (GFZ)
Prof. Dr. Reinhard Kurth †	formerly Robert Koch-Institut
Dr. Roland Wagner	Georg-August-Universität Göttingen

Visitors

Dr. Arlena Jung	Wissenschaftszentrum Berlin für Sozialforschung (WZB)
Prof. Dr. Frank Marcinkowski	Westfälische Wilhelms-Universität Münster
Prof. Dr. Hans Peter	Forschungszentrum Jülich

and on 5 December 2012

Sascha Karberg	Journalistenbüro Schnittstelle
Christoph Koch	stern
Beatrice Lugger	Nationales Institut für Wissenschaftskommunikation (NaWiK)/ Quantensprung blog
Lutz Marmor	Norddeutscher Rundfunk

Visitors

Dr. Martina Franzen	Universität Bielefeld
Dr. Simone Rödder	Universität Hamburg

Individual interviews were also conducted with the following experts

Markus Weißkopf	Wissenschaft im Dialog gGmbH (9 October 2012)
Prof. Dr. Günter Ziegler	Freie Universität Berlin (16 October 2012)
Prof. Dr. Jörg Steinbach and Stefanie Terp	Technische Universität Berlin (25 October 2012)
Prof. Dr. Peter-André Alt and Anna Dannenberg	Freie Universität Berlin (25 October 2012)

Written expert opinions were requested from

Dr. Martina Franzen	Universität Bielefeld
Prof. Dr. Frank Lobigs	Technische Universität Dortmund
Prof. Dr. Christoph Neuberger	Ludwig-Maximilians-Universität München
Dr. Birgit Metzger and Dr. Roland Wagner	Albrecht-Ludwigs-Universität Freiburg Georg-August-Universität Göttingen
Dr. Simone Rödder	Universität Hamburg
Prof. Dr. Mike S. Schäfer	Universität Zürich
Dr. Tabea Schönbauer	Munich
Prof. Dr. Gabriele Siegert	Universität Zürich

These written expert opinions were discussed on 18 January 2013 and 22 April 2013 in meetings of the working group (sometimes in the presence of the authors) and are published in Peter Weingart and Patricia Schulz (Eds.): Wissen – Nachricht – Sensation. Zur Kommunikation zwischen Wissenschaft, Öffentlichkeit und Medien (Velbrück / Weilerswist 2014).

In meetings of the working group on 20 March, 22 April, 15 May and 19 June 2013, drafts of the position paper and recommendations were discussed within the working group on the basis of research, conversations and hearings with experts, and expertises.

The position paper was adopted by the Standing Committee of the National Academy of Sciences Leopoldina on March 2014.

The academies would like to thank all participants. The academies are solely responsible for the content of this position paper.

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