Chapter 2
The Lure of the Mass Media and Its Repercussions on Science

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2.1 The Issue

The thesis of the 'medialization of science' stipulates that the relationship between science and the media has changed substantially over the few last decades due to a growing dominance of the mass media[1] in public communication. It has become problematic because science (like politics) is adapting to the criteria of media communication which seems to imply that the criteria of scientific knowledge generation are losing their orienting function. In fact, the issue has become more pressing exactly because the opening up of science to the public has become the accepted expectation by policymakers everywhere. The demands for accountability are motivated by the public legitimation of science needed in democratic societies and have seeped into management and evaluation schemes governing academic institutions.

Assessments about the nature of the new relationship between science and the media and its effects on science diverge. One established view is that communication of scientific knowledge to and in the mass media 'distorts' that knowledge because of its esoteric nature. There is also the opposite stance, that scientific knowledge *should* be communicated to the public since they have a right to that knowledge either because they have paid for it and/or because, in democratic societies, no single group has a right to monopolize superior and specialized knowledge. Finally, there is a middle ground position claiming that scientific knowledge is already being communicated to different kinds of publics that may be differentiated and ordered along a continuum ranging from the specialists' communities to the broad public and therefore the issue is not new. The diversity of the discussion has, by now,

[1] The term 'media' in this context relates to mass media only, i.e., any media which are produced by editorial staffs and are addressed to an unspecific public (regardless of its special profile of interests targeted by the media, see below). The obvious ones are newspapers, television, radio and web-based news media (see Chapter 1).

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initiated an entire research field which is not only characterized by different theoretical approaches, but also by a mix of explicit and implicit normative assumptions and objectives, both of which are often conflated.

In the following, I want to develop the argument that science is being medialized and give reasons why and to what extent this is problematic for science (and indirectly also for society). First, to set the stage I will briefly define different kinds of knowledge and different kinds of publics among which they are communicated in order to show why, in spite of many similarities, the communication between science and the general public via the mass media is not without problems. Then I will develop the concept of medialization itself from an analytical perspective that differs from those either claiming the distortion, if not disappearance, of science or denying a boundary between its publics. In that context, I will differentiate different levels (interaction, organization, system/program) on which medialization takes place and the respective repercussions on science.

2.2 Similarities and Differences Between Communication in Science and by the Mass Media: Types of Knowledge and Publics Addressed

There are interesting similarities between scientific and mass media communication which allow for a certain degree of ambivalence when trying to distinguish between them. Both rely on technologies of diffusion such as printing or digitalization. Both attempt to catch the attention of the recipients, and both do so by trying to establish credibility. For both 'novelty' is a primary value. Earlier in history, the publics of science and the media were not quite as sharply separated as they are now. That is part of the issue, however, insofar as both science and the media have differentiated from one another (see Section 2.3).

But then, the differences appear. Knowledge production and communication within science, although also searching for attention, basically rely on the recognition of 'relevance' and 'novelty' with reference to knowledge that is already known and questions that are posed. Relevance and novelty are ideally determined by the entire community of specialists involved in the process of knowledge production and communication. The production of scientific knowledge is guided by more or less explicit research agendas, based on the application of an elaborate set of methods. There are no comparable mechanisms in mass communication. Mass media communicate 'new events' and – like science and all other social systems – 'create' their own 'reality' by selecting and shaping them according to so-called 'news values' – interpreted and applied by editors and journalists – which steer the attention of the media. (Even if they repeat known facts they have to give them the appearance of newness). The media *observe* society.

Although even the media know a certain amount of self-referentiality (i.e., they cite each other), this is not systematic, leading to cumulative knowledge production like in science. Note that this criterion distinguishes more clearly between the media

and the natural sciences than between the media and the social sciences and humanities. Knowledge production in the latter is not cumulative or only so to a much lesser degree. Thus, scholars of literature publish both in their specialized journals and in high-brow mass media. Controversies within disciplines of the social sciences and humanities such as that over Daniel Goldhagen's book *Hitler's Willing Executioners*, or between the German archaeologists Korfmann and Kolb over the interpretation of archeological finds to determine the location and importance of Troy, evidently find their way more easily into the media (Weingart and Pansegrau 1999; Chapter 15). The content is more accessible and the knowledge involved is part of a discourse among the broader educated public.

An important distinction between the types of knowledge communicated by science and the mass media emanates from their differences in credibility. In the communication among scientists (intra-specialist), credibility is created by an elaborate system of 'checks' that establish the objectivity and validity of the knowledge produced. These checks take the form of critique by specialists before publication, of 'peer review' controlling publication, the concealment of authors and reviewers to avoid conflicts of interest, and strict rules governing the originality and authorship of publications to prevent fraudulent communication. Most indicative of the sensitivity of these mechanisms with respect to their function of quality assurance are the reactions to their violations. Incidents of fraud, fabrication of data or just plain plagiarism are not only sanctioned by the scientific community but are formally examined by institutional review boards, and they are reported widely in the media reflecting their perception that the trustworthiness of science is of high public interest. Although many newspapers and public TV channels claim impartiality vis-à-vis governments, political parties and their ideologies, and quality journalism tries to establish credibility the quality assurance even in good newspapers or television does not match that in science. Boulevard journalism operates completely outside these concerns. As a result, trust in science as an institution is invariably higher than trust in the media. This pattern is remarkably stable across different societies and over time (see Europäische Kommission 2010).

The *differences in knowledge communication between science and the media* are inextricably connected with the social organization of the knowledge producers and with the publics addressed by their communications. Communication in science relies on a clearly defined set of criteria of exclusion (or inclusion resp.) delineating the public to be addressed. These criteria may be summarized implicitly as *competence*. Competence is constituted, first of all and formally, by certificates indicating the successful conclusion of an education and, secondly, by past participation in contributions to the creation of knowledge (research) and their communication (publications) which have been certified by 'competent' peers. Communication in science involves *communities* of scholars who are bound by work on problems which they perceive as being of mutual interest. Thus, such communities are constituted by a network of topics, problems, and answers. Individual members providing inputs (research results), and who often know each other personally, attribute reputation to each other as a reflection of the perceived value of their contributions to the common endeavor. This is a self-reinforcing mechanism since the hierarchy

of reputation in each field also provides the orientation of the work agenda and thus the consensually perceived relevance of knowledge. Individuals hardly matter, they may enter and leave the respective community without affecting its continuity which demonstrates the degree of institutionalization of research fields. The mass media, on the other hand, do not address communities delineated by criteria of inclusion and exclusion, let alone constituted by criteria of competence. Most commonly they address unspecific publics, as large as possible because that usually translates into profits, the chief objective of the media as commercial enterprises. As publics have become differentiated according to their interests, the media try to capture their attention by, first of all, researching their specific profiles: demographic, social structural, life style, etc. Although they may be very successful in 'profiling' their prospective audiences, the public they address remains unknown to them in principle. (Mass) Media and their publics are connected through contingent expectations rather than direct reciprocal communication.

Even if the media cater to quite specific publics, e.g., bikers, hobby gardeners, or teenagers, they address a particular interest profile of potential readers/viewers. Neither does the reception of and contribution to the communication require proof of competence, nor do they constitute an institutionalized community with rules of inclusion and exclusion. 'Letters to the editor,' although known to both communication cultures, do not fulfil the same function in each of them. Some mass media mimic the reciprocity of scientific communication by staging debates or controversies over a certain topic, but they are not sustained, they do not constitute communities and they are not subject to similar processes of quality control.

One could try to play down the differences by pointing out that quality controls do not always work well in scientific communication while some journalists meet very high quality standards. Empirical variations are not relevant, however. What count are the systematic, institutionalized differences.

The systematic differences between communication in and by science and by the mass media explain (1) why scientific communication enjoys trust both among the scientists and the public; and (2) why a conflation of media used and publics addressed in scientific communication is perceived as problematic by scientists. The suspicion or even downright contempt of scientists towards any trespassing of the demarcation line between the 'internal' and the 'external' communication channels is relevant insofar as it indicates a well based fear that the proper operation of the mechanism of the attribution of reputation may be disrupted. The consequences of such disruption could be grave, indeed. If criteria other than those deemed relevant by the competent members of the community would be applied in the evaluation of contributions to knowledge, the basis for trust in the communications of other peers would erode, and with that the orientation which questions to pursue and which to leave unanswered, which colleagues to pay attention to and which to ignore would be lost. In other words: The evolutionary advantage of differentiation that the system of knowledge production as we know it represents would be reversed.

This does not mean that scientists do not address other communities than their own. They do in many ways. Most common is their communication with the broader public through various forms of popularization ranging from books and articles to exhibitions and image campaigns. But authors who become recognized as

popularizers do not normally compete with scientists for reputation within science.[2] If scientists themselves popularize their research findings or write textbooks, they distinguish this activity from research proper. This institutional separation of social roles as well as activities and their products was gradually achieved in the course of the nineteenth century and completed at its end. In other words, popularization and research are clearly distinguishable activities involving different publics.

Today's image campaigns for science, 'science exhibitions,' and various types of science events are typically commissioned by governments and/or science administrations such as research councils and foundations. They are designed and executed by professional PR firms which enlist scientists' help to provide substance. In contrast to the earlier forms of popularization, they are targeted to large unspecific audiences. Their success is usually measured in attendance, not in sustained behavioral change although raising interest in the sciences among children and acceptance in the general population is their purported objective.

Fleck as well as Cloître and Shinn have argued that the communication from science to the public is a continuum rather than dichotomous (Fleck 1980; Cloître and Shinn 1985; see Chapter 1). Here the point is that even though communication from one discipline to another (inter-specialist) may involve popularization and therefore be seen on a continuum, it is still considered 'internal' to science, in contrast to popularization to the outside public. The evaluation of competence is still the crucial mechanism in upholding that distinction. The difficulties to institutionalize interdisciplinary research illustrate this succinctly: Specialists from different disciplines have fewer problems understanding each other and, consequently, less need to 'popularize' for their colleagues if their subject matters and specialized languages are 'close together' like physics and mathematics. In such cases, they are also able to mutually judge each others' competence. On the other hand, if their disciplines are far apart like atmospheric physics and economics (as in climate research), the inability to understand each others' terminology implies the inability to judge each others' competence and thus the need to popularize. Experts on both sides then have to rely on the established reputation as it 'is known in the field.' However, there is still a borderline between this 'internal' popularization – to the extent that it happens – and that which is directed to the so-called lay public.

Massimiano Bucchi has convincingly argued that – beyond the continuity model that adequately describes the information flow from science to the public – there are exceptional cases. These are cases when scientists turn directly to the public such as the formation of new disciplines or research fields ('constitutive boundary work,' as Bucchi calls it and cites environmental and information sciences (1996: 382)). These cases are seen as 'deviations' from the normal pattern of popularization, and although they count as a specific resource for the scientists, they are at the same time looked upon with great apprehension. There is a

[2] Historically, the role of popularizer has become quasi professionalized at the end of the nineteenth century. Till today borderline examples come to mind: Gould, Dawkins, Sagan, etc. However, they do not falsify the claim.

> tension [. . .] within the scientific community between absorbing [. . .] deviation into ordinary expository practice (popularization) to avoid its 'uncontrolled abuse,' and at the same time preserving it as a sort of 'emergency exit' for specific situations as well as a potential source of scientific change (ibid.: 387).

This tension reflects the borderline between the 'internal' and the 'external' publics and the conflicting expectations (and opportunities) to communicate to them.

A final argument could be to claim that the lay public may, in certain constellations, gain competence in a particular field of scientific research and that such a development would level the distinction between the intra- and inter-specialist publics, on the one hand, and the lay public on the other. There are examples where this claim has some justification: so-called 'round tables,' citizens fora, and similar arrangements in which representatives of the lay public are brought together with scientists to negotiate questions of hazard and risk with respect to particular experiments (e.g., genetically modified corn) or technologies (nuclear power). Perhaps even more compelling are those cases where activist groups negotiated with experts over changing research priorities as the incidents reported by Epstein about AIDS groups (Epstein 1995). AIDS treatment activists were able to establish themselves as credible participants in the process of knowledge construction and actually affected changes in the epistemic practices of biomedical research. But in order to achieve this role, activists and citizens had to obtain considerable competence in the respective research fields to meet with the scientists on the same level. In fact, their estrangement from their fellow citizens due to their acquired competence is a topic of research on its own.

It must be concluded, then, that in spite of many similarities between types of knowledge and publics addressed in the communication of science and the mass media, crucial differences remain. They explain the uneasiness among scientists vis à vis the direct communication with the mass media. This uneasiness or rather the institutionalized assessment is an indication of the differences between scientific and mass media communication. To conclude this argument: The more cumulative the knowledge, the more firmly institutionalized the certification of this knowledge and of its producers' competence, *the more pronounced are the differences to the mass media*. A confounding of science's publics can create conflicting expectations for science communication. The question, then, is what dimensions this conflict has and which repercussions for science it implies.

2.3 Democratization and the Emergence of Mass Media

Before pursuing the analytical argument, it must be briefly explained which rather recent developments have led to the present state of what is being described as the medialization of science. Historically, *science* has communicated to a broader public. But in this process both science and the publics have changed fundamentally and the same must be said for the media. Modern science emerged first in the mid

seventeenth century but although communication among scientists (the very term 'scientist' was coined by Whewell only in 1833) began in correspondences and specialized journals once the Royal Society had been founded, it also extended to different publics: curious members of the aristocracy at the courts of Europe, onlookers on markets watching experiments executed in public, later on members of the educated bourgeoisie and working class in the lecture halls in Paris, London, Berlin and Vienna where scientists themselves or, gradually taking over from them, popularizers presented the newest wonders of science. By then the communication among scientists had withdrawn into their more and more numerous specialized journals, experiments were no longer carried out in public but in laboratories and were reported about later. Circa 1830 disciplines in the modern sense had emerged replacing natural philosophy. A century later, scientific research especially in the natural sciences had become so specialized that communication was de facto incomprehensible to the lay public and even across disciplinary lines (Bensaude-Vincent 2001).

The crucial point in the development of the *media* is their shifting nature to become true mass media. This has a technical, a political and an economic aspect. Technically, the major advances are the invention of high pressure rotation printing, of the radio in the 1890s and of television in the 1930s. By the mid 1930s radio broadcasting had become a mass medium, i.e., counting millions of listeners. Economically, newspapers that had been published by political parties or by small publishers as 'opinion press' began to address a mass public, beginning in the 1870s. By the turn of the century newspapers had become economic enterprises rather than instruments of political organizations, even though their publishers used them for political purposes like Hearst in the US and Ullstein and (in the 1920s) Hugenberg in Germany. This commercialization of the print media (later also of radio and TV) constituted or reinforced 'news values' as operational criteria which from now on governed them. Politically, these developments were framed by the emergence of a mass society, first triggered by capitalism and the creation of a large industrial workforce organizing in the labour movement in the nineteenth century. This movement brought about the eventual democratization of the Western industrializing nations after World War II. Democratization and the development of mass media go hand in hand as the general public, i.e., the entire population, becomes, in principle, the target audience of the media. From now on the legitimacy of political organizations, individual politicians and governments but also of societal institutions like science is largely determined by the mass media as they assume the central communicating function in mass democracies. The mass media articulate expectations *as if* representing the general public.

Here an important difference between science and politics in mass democracies becomes apparent: Politics derives its legitimacy from the general public only. For science two publics are relevant: The general public is the source of legitimacy with respect to the funds and the institutional support it provides, whereas the specialized scholarly public is the source of legitimacy for judgments of the quality of truth claims and the attribution of reputation to scientists and/or their institutions.

Democratization has led to a recent shift in weight to the former in the sense that accountability to the general public is considered more important than before.

Given their ubiquity the mass media have dramatically changed the *attention economy*. Space and time to make oneself heard and to actually be listened to are expanded continuously but, parallel to that, the inflationary use of communication creates an ever growing, self-accellerating pressure to participate in the competition for attention. Science is no exception.

2.4 Conceptualizing the 'Medialization' of Science

The thesis of the 'medialization' of science (see Chapter 1) has initiated a number of studies that have attempted to determine the actual effects of the orientation to the media (see Weingart 1998; Peters et al. 2008; Rödder 2009; Franzen 2011). There is general agreement on at least three observations: (1) The orientation of science to the mass media has grown more intense; (2) This may create tensions of different degrees of severity within science because the orientation to the media is in conflict with rules and values prevailing in science; (3) These tensions are expressed in the dilemma in which scientists find themselves because the demand to communicate with the public has become part of their legitimating exercises in the context of mass democracies whose publics and political leaderships no longer recognize and accept the professional elites' privilege of virtual unaccountability. Differences exist over the reach and impact of media orientation on science. They range from discarding them as 'just show' which has no effect whatsoever, to a doomsday scenario in which science ultimately dissolves into the media. The differences of interpretation are due to different theoretical frameworks in which they are developed, and sometimes also due to different normative positions.

In order to come to a common interpretation, one has to choose a theoretical framework that allows to take account of the distinctions between communication of science and of the mass media developed above. At the same time it should make it possible to identify the impacts of the orientation of science communication to the mass media.

The framework chosen here is that of systems theory for the simple reason that it proceeds from the very fundamental distinction between science and the media as the result of the (historical) functional differentiation of modern societies. Without this differentiation the fairly recent developments in the relation between science and the mass media would not even be a problem, just as the communication of scientific knowledge to the public was not a problem before that differentiation occurred in the seventeenth to mid nineteenth centuries. This theoretical framework has the advantage over others that it maintains distinctions that allow descriptions in a seemingly confused real world. These other approaches are based on vague concepts (e.g., 'Mode-2') which require considerable descriptive and interpretive input without providing criteria that allow to delineate change. Even though they often postulate convergence or a 'blurring of boundaries,' they still have to rely on the very distinctions which are supposedly disappearing. Not only is it highly

questionable to claim the complete diffusion of science into the mass media in the face of counter evidence and, likewise, to promote 'dialogues,' 'engagement' and 'participation' between science and the public as if there were no barriers of specialized knowledge and training. It can neither be justified nor explained theoretically in these frameworks.

2.4.1 Science as a Social System and the Science-Media Coupling

Sociological systems theory suggests that modern societies are differentiated into a set of functional systems: politics, the economy, law, religion, science and (with some qualification) the media (Luhmann 1995). These systems are autonomous in the sense that they are defined by their respective operating codes, in the case of science it is *truth* (see also Chapter 1), for the political system it is *power*, for the economic system it is *profit*, etc. In reality, this means that in any pertinent communication it is possible to identify the distinction between 'truth' and 'non-truth,' no matter how convoluted it may appear, and that it cannot be merged with others. A simple expression of this is the famous dictum that 'truth cannot be established by majority vote, nor bought with money, nor mandated by edict.' As long as this distinction is present in communications, no matter if it may be violated from time to time, functional differentiation is a social reality.

A further consequence of this categorization is that systems cannot merge, nor can one dominate the other. If that were to happen, it would be tantamount to a reversal of the epochal evolution of human societies. Systems can only 'irritate' each other. They can act upon each other creating resonance, and they can be coupled on the basis of mutual expectations. *Differentiation of codes implies that systems have their own 'frequencies' with which they react to external irritations*. This means that there cannot be a one-dimensional and uni-linear communication of meaning between systems. What appears relevant in one system is not equally relevant in another. Typically, the fault between systems becomes apparent in scientific advice to policymakers when what appears to be certified and objective knowledge is transformed into decisions in a highly selective and often seemingly irrational manner. Thus, irritations from one system can only be processed in another system in its specific mode of communication. Assumptions about causality as in theories of steering are too simple in view of a more complex reality.

Luhmann used two parallel concepts to describe inter-systems relations: *coupling* and *resonance*. Coupling as a metaphor is taken from biology and refers to the mutual dependencies between systems and their environments. Applied to the social realm this mutual dependency exists in the form of expectations and services. In our case: Science provides a steady stream of information to the media. Not all of it is interesting to them but some is: The discovery of a new star, the spread of a virus, the extinction of a particular species are all information communicated by science on which the media rely for their news reporting. The mass media, on the other hand, are coupled with science because science relies on the media's focusing of public attention on important discoveries and, indirectly, demonstrating its utility and

legitimating its costs. The political expectation that science be accountable involves, to a large degree, the media which have to spread the message to the general public. The coupling of systems, therefore, constitutes the connections and dependencies between them without which mutual impacts, i.e., resonance, would not be possible.

2.4.2 Resonance Between Science and the Media

Resonance is a metaphor borrowed from physics where the term denotes the irritation or agitation of a system capable of oscillation. The crucial variable is resonance frequency which means that oscillations caused by energy input from outside the system may cumulate and, in the extreme case, lead to catastrophic destructions (like in the case of bridges which can collapse under the impact of marching troops). The opposite is that irritations from outside have no effect at all, i.e., the system does not resonate. The medialization thesis focuses interest on the science side of resonance effects. To cite an example: In the mid 1970s, climate scientists postulated anthropogenic global warming, sometimes with alarming predictions in order to capture media (and ultimately political) attention. They used exaggerated claims, thereby adapting to the media's criteria of relevance. The issue enjoyed a relatively high level of interest from the media for years. At least some climate researchers use this attention to advance their political message. But they do not anticipate the cyclical nature of this attention. When the attraction of climate change as an issue seems to wear out the media suddenly begin to question the credibility of the climatologists' thesis of imminent anthropogenic global warming. Controversies among climate researchers are interpreted as conflicts, suppression of opposition, and manipulation of information. A simple error in an authoritative report on the state of research is reason for the media to accuse the scientists of forging their data. Now the scientists struggle to regain their credibility (see Weingart et al. 2007).

To exploit the metaphor a little more: If the 'irritation' meets the particular 'resonance frequency' of the system it has an amplifying effect. In the example, the crucial irritation is not the reporting of disputes between global warming advocates and sceptics but the questioning of the formers' motives as being politically interested and, thus, untrustworthy. The allegation of untrustworthiness on account of manipulation, fraud or politicization is the strongest that can be raised against science. One reaction is for scientists to stage public relations campaigns to gain public acceptance. This has already happened in several instances, e.g., nuclear power, genetic engineering, stem cell research to name the most conspicuous.

The next question concerns the actual effects, i.e., the amplitudes or kinds of resonance. The interest in gauging the possible effects on science points to different levels on which such effects can occur or not.

To gauge the effect of medialization, systems theory suggests three levels on which these effects may occur. These levels incorporate various empirical observations and at the same time allow to distinguish between them according to their range and impact on science. These are the interactional, the organizational and the program level.

(1) The strongest resonance would be on the systems level, i.e., if the orientation of science to the media would effectively lead to the displacement of epistemic criteria of novelty, relevance and robustness (all with reference to the scientifically certified body of knowledge) by the media's criteria of news values. In this case, the production of knowledge would clearly be affected, one could not speak of scientific communication anymore. This is *not very likely to happen.*

Very well imaginable, however, is that the orientation to the media may have effects on what in systems theory is called the 'program level.' Programs are the variable aspect of codes (which are constant). 'Theories' and 'methods' are programs of the code of 'truth.' If one method is replaced by another, this does not affect the code (see Luhmann 1990: 401ff).

(2) A probably lesser impact would be one on the interactional level. On the *level of interaction,* scientists do not 'normally' communicate with journalists but only with their peers. This is exemplified by the fact that *reputation* within the scientific community, which is the basis of the social structure of science, cannot be gained by communicating with the media.[3] In fact, as described above, there is a clearly defined demarcation line based on the criterion of 'competence' that separates science (or rather research fields) from other systems (i.e., the environment of science). In the media, the analogon to reputation in science is *prominence*. It shares with reputation that it denotes visibility based on achievement, but the crucial systemic difference is what counts as achievement. In science, in accordance with its code, it is the generation of new knowledge. In the media system, in accordance with its code, it is attraction of public interest based on news values. Prominence may be gained by movie stars, politicians, bank robbers and murderers alike. Scientists can also acquire media prominence but prominence cannot *normally* be translated into scientific reputation and vice versa (see Weingart and Pansegrau 1999). In the logic of systems theory this implies: If media prominence were to be transformable into reputation, the mechanism of allocation of reputation would not operate any more.

(3) The least far reaching effects may be expected on the level of organization. Organizations exist to achieve certain decisions. They can cut across social systems and have references to each of them. Universities are a case in point. They are linked to the science system through research. At the same time, the other of their chief functions is teaching. Increasingly, they are involved in technology transfer which requires them to operate in terms of the economic system. The same holds for their administrations – if they are financially at least partially independent – which have to calculate like commercial companies.

[3] As argued above, this differs among disciplines. In some fields in the humanities (e.g., history, literary sciences), the educated public of highbrow newspapers is a legitimate source of reputation. But even in these fields the ultimate criterion is acclaim from peers, as the Goldhagen case has demonstrated.

The effects of medialization on science can, thus, be defined more precisely by differentiating between these three levels giving guidance to the interpretation of the variety of empirical observations usually subsumed under the term *medialization*.

Ad 1) Orientation to the media may have an impact on the *program level* in different ways. For example, if a positivist epistemology is replaced by a constructivist epistemology or if linear causality loses out against chaos theory, this may be due to amplifying effects of media reporting and is, in fact, criticized in the respective scientific communities as such. It does not put the code of science itself into question but it implies that the self-direction of science is weakened and no longer functions in the traditional manner of disciplinary self-referentiality. Instead, value preferences of the public as communicated by the media serve as *additional* references, when, for example, new kinds of research fields emerge such as 'gender studies' or 'environmental studies' (Maasen and Weingart 2000; Chapter 5; Luhmann 1990: 401ff). These fields reflect the resonance of the science system to public discourse staged by the mass media. They are not products of the self-referential development of the landscape of disciplines.

Ad 2) There are rare cases which may be taken to illustrate that media prominence has helped scientists to gain reputation in science but upon closer examination they do not quite prove the point. Historian Daniel Goldhagen's media prominence has not survived scrutiny by peers when he was up for an academic appointment. (As a humanities scholar whose audiences are also outside his discipline he represents a borderline case anyway). Pons and Fleischman, the two scientists who claimed to have achieved 'cold fusion,' only temporarily succeeded in communicating exclusively through the mass media (TV and newspapers) until the peer review mechanism prevailed (Lewenstein 1995).

Rödder (2009) has shown that among geneticists, even though this is a community that is more exposed to the media's limelight, there is still a hierarchy of acceptance of different motives to search media attention. Lobbying for science in general or for one's own discipline is accepted while advertising for personal gain and prominence is not. In contrast, in the social science and humanities, crossing the line between 'internal' communication and communication to and in the mass media is much easier and generally more accepted.

Ad 3) The resonance on the organizational level, i.e., what effects it has on science when scientific organizations deal with expectations of communicating with the public, is less obvious. Universities and research organizations have set up their own PR offices which produce reports directed to the broader public and the media in order to attract students and sponsors. They also engage in the formulation of 'mission statements' that are directed to their boards of trustees, their community and to policymakers legitimating their actions and performance. These are ways of representing the university to the public, and the means to do this are media oriented. (The growth and increased influence of media trained staff in science organizations is a clear indicator). None of these developments affects the research process itself, at least not immediately. They are independent from it. In some cases, universities have even established rules that shield scientists from communicating with the media by controlling media access. The multitude of systems references and their

apparent combinations, therefore, is not yet an indication of medialization in the sense of 'blurring boundaries.' Yet, it can still be asked, for example, if the costly PR activities of universities are actually fulfilling their purpose of reaching a target group whose decisions are supposed to be influenced in favor of the university in question, or if they are simply an activity reacting to a general trend of media orientation with no specific public addressed. There is no doubt that these activities drain the resources, both in terms of time and money, of any organization.

But it is common knowledge that symbolic actions and rituals have an impact on organizations, as do bureaucratic rules. It is by no means clear what kind of representation remains just that on the front stage and how much effort on the level of representation will ultimately have repercussions on the backstage, i.e., on the production process itself. It can be assumed that PR campaigns on behalf of particular research fields or the popularization of its discoveries will not affect the research process and the epistemic criteria involved.[4] However, if reference to the public (via the media) is perceived to be so important for the legitimacy of research that scientists exaggerate their truth claims as in the case of climate change, stem cell research or nano-technology, this may have repercussions on the validity of theories and methods. In such cases, media orientation on the program level may imply that the respective communication can no longer be considered scientific.

There are also indirect effects. The introduction of performance measures and their focus on quantitative indicators that can be expressed in simple numbers has in some cases been introduced by the media and rankings are continuously reported in widely visible print media such as THES. They play ideally to the news value of competition and picking winners. Their effects, both intended and unintended, on the organizations which they purport to measure are profound (Weingart 2005; Espeland and Sauder 2007).

Another resonance of 'medialization' has been identified in a particular sector of scientific communication (see Chapter 17). The link of top journals such as *Science* and *Nature* to the mass media by way of pre-publication press releases and related promotional activities that play to the news values of novelty and sensation has an impact on the communication process. The *acceleration* of the publication process together with the ambitious search for high-impact papers comes at the price of increased incidents of exaggerated claims that had to be taken back by the respective journals in retractions. It has to be noted that the communication of results in scientific journals (!) is a part of knowledge production considering that the communication process never ends and through peer review contributes to the certification of knowledge.

The top journals' orientation to the mass media also seems to result in a selection in favor of spectacular, surprising research results while reporting on 'normal science' is relegated to less visible journals (see Franzen 2011). This selectivity tends

[4] It is interesting, though not a counter argument, that nano scientists, after having had success with their public propaganda in capturing media and political attention, have shrugged back from it, presumably for fear of becoming its victims (Lit. in Kaiser et al. 2010; for genome researchers see Rödder 2009).

to contribute to the creation of topical cycles which steer attention in the selection of research topics. Focusing attention in this way usually also implies the extension of the public of this communication from the narrower scientific community to the broad political public.

But when it becomes more important to publish an article containing 'sensational news' rather than to make sure that the news is 'true' and recognized as such by the scientific community, obviously the mass media's public is considered more important than the 'public' of peers. At the same time, this obstructs the internal communication process and, thus, indirectly the production of knowledge. Strictly speaking, orientation to the media has then replaced orientation to 'truth.'[5]

2.5 Conclusion: Medialization as Coupling of Systems

From the preceding analysis a number of conclusions can be drawn: (1) It is very useful to conceptualize 'medialization' of science distinguishing effects that can be identified on the organizational, interaction and program levels. (2) Rather than limiting the term 'medialization' to effects with regard to the code, i.e., to de-differentiation, only to conclude that it does not happen it appears more productive to subsume a broad variety of phenomena of science's media orientation under the concept and to use the previous distinction to specify the degree of conflict. There is, furthermore, a theoretical and a substantive conclusion.

The theoretical conclusion leads back to the concept of coupling. Coupling describes dependencies between systems due to mutual services (performance). In one sense, this description is quasi definitional: The science system is coupled to the system of politics because it provides knowledge for decision making and legitimacy in exchange for public funds. In this sense, couplings either exist or they do not. In another sense, however, they can differ in degree of tightness: Public funds may be replaced by private funds. Scientific knowledge may compete or even be replaced by knowledge produced by religious institutions which also provide legitimacy for governments. Just as much as couplings between systems can therefore change in intensity, so can medialization. In fact, medialization is a special case of the coupling between science and the media. By conceptualizing their relationship in this way, the danger of dramatizing phenomena or confounding them is avoided while, at the same time, allowing for the differentiation of various kinds of configurations that surprise the observer time and again. Only in this way can the conceptual apparatus cope with ever new developments among which the complete disappearance of science is the most unlikely one.

The substantive conclusion is that the theoretical approach allows for a differentiated view of medialization. The medialization of science is not good or bad as

[5] This illustrates, by the way, why the orientation to other relevant references is analytically akin to scientific misconduct. In many cases (e.g., Hwang, Schön) media hype triggered by *Science* and/or *Nature* played a role.

such but must be seen as a new kind of coupling of science with the media and – through them – with other social systems. This will not leave science unaffected.

Thus, the focusing of topics through the media is part of their attention management and concerns the agenda of science. Likewise, extending the public to include economics and politics may be functional for science if it mobilizes research funds, for example. However, if political or economic considerations enter into the evaluation of research results or the recruiting of staff, that becomes problematic because it affects the validity and credibility of scientific knowledge. Even the acceleration of the publication process may be positive in that it promotes the development of science as long as it does not compromise the quality assessment mechanisms. The exaggeration of results is seen as an undesirable side-effect of the medialization of science (see Chapter 17). It can be traced to the combination of media orientation and its implementation in incentive schemes that reward publications in top journals with the prospect of career advancement.

Cases like these are (still) isolated incidents. They occur in particular research areas which enjoy unusual public attention already and which have considerable economic implications for the media and the scientists involved. But even the cases which are supposedly limited to effects on the organizational level may be significant. A university that is forced to compete with others for public funds and students and puts an emphasis on communication oriented to the mass media may, as a consequence, decide to prioritize research fields which promise greater acceptance among policymakers. A scientist who is remunerated at least in part on the basis of his/her publications in high impact journals and the number of citations they receive may decide to work on topics that are more likely to be 'news worthy' and have a higher probability of being published in *Science* or *Nature*. The one overall conclusion is that the orientation to the media weakens science's self-direction. The self-referentiality of the disciplines that characterized the development of science through much of the twentieth century is gradually complemented by reference to the mass public. This should not come as a surprise as it indicates a new place for science in a changed social and political environment, i.e., mass democratic societies: The interests and values of their publics communicated by the media become an important referent for science. While the boundaries of science may become more permeable with respect to problems addressed, this does not necessarily imply that the production of certified knowledge will cease to happen. Science will be more responsive to society at large but the welfare of society will continue to depend on reliable knowledge.

References

Bensaude-Vincent, B. (2001). A genealogy of the increasing gap between science and the public, *Public Understanding of Science*, 10(1), 99–113.

Bucchi, M. (1996). When scientists turn to the public: Alternative routes in science communication. *Public Understanding of Science*, 5(4), 375–394.

Cloître, M. and T. Shinn (1985). Expository practice: Social, cognitive and epistemological linkages. In M. Cloître and T. Shinn (eds.), *Expository science: Forms and functions of popularization*. Dordrecht: D. Reidel, pp. 31–60.

Epstein, S. (1995). The construction of lay expertise: AIDS activism and the forging of credibility in the reform of clinical trials. *Science, Technology & Human Values*, 20(4), 408–437.

Espeland, W. and M. Sauder (2007). Rankings and reactivity: How public measures recreate social worlds. *American Journal of Sociology*, 113(1), 1–40.

Europäische Kommission (ed.) (2010). Eurobarometer Science and Technology Report.

Fleck, L. (1980). *Entstehung und Entwicklung einer wissenschaftlichen Tatsache*. Frankfurt/M.: Suhrkamp.

Franzen, M. (2011). *Breaking news. Wissenschaftliche Zeitschriften im Kampf um Aufmerksamkeit*. Baden-Baden: Nomos.

Lewenstein, B. V. (1995). From fax to facts: Communication in the cold fusion saga. *Social Studies of Science*, 25(3), 403–436.

Luhmann, N. (1990). *Die Wissenschaft der Gesellschaft*. Frankfurt/M.: Suhrkamp.

Luhmann, N. (1995). *Social systems*, Stanford: Stanford University Press.

Kaiser, M., et al. (eds.) (2010). *Governing future technologies. Nanotechnology and the rise of an assessment regime, Yearbook Sociology of the Sciences 27*. Dordrecht: Springer.

Maasen, S. and P. Weingart (2000). *Metaphors and the dynamics of knowledge*. London/New York: Routledge.

Peters, H. P., et al. (2008). Medialization of science as a prerequisite of its legitimation and political relevance. In D. Cheng et al. (eds.), *Communicating science in social contexts: New models, new practices*. Dordrecht: Springer, pp. 71–92.

Rödder, S. (2009). *Wahrhaft sichtbar. Humangenomforscher in der Öffentlichkeit*. Baden-Baden: Nomos.

Weingart, P. (1998). Science and the media. *Research Policy*, 27(9), 869–879.

Weingart, P. (2005). Impact of bibliometrics upon the science system: Inadvertent consequences? *Scientometrics*, 62, 117–131.

Weingart, P. and P. Pansegrau (1999). Reputation in science and prominence in the media – The Goldhagen Debate. *Public Understanding of Science*, 8(1), 1–16.

Weingart, P., A. Engels, and P. Pansegrau (2007). *Von der Hypothese zur Katastrophe. Der anthropogene Klimawandel im Diskurs zwischen Wissenschaft, Politik und Massenmedien. With cooperation of Tillmann Hornschuh* (2nd ed.). Leverkusen Opladen: Barbara Budrich.