

## Article

# Scientists and science communication: a Danish survey

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*This paper summarizes key findings from a web-based questionnaire survey among Danish scientists in the natural sciences and engineering science. In line with the Act on Universities of 2003 enforcing science communication as a university obligation next to research and teaching, the respondents take a keen interest in communicating science, especially through the news media. However, they also do have mixed feeling about the quality of science communication in the news. Moreover, a majority of the respondents would like to give higher priority to science communication. More than half reply that they are willing to allocate up to 2% of total research funding in Denmark to science communication. Further, the respondents indicate that they would welcome a wider variety of science communication initiatives aimed at many types of target groups. They do not see the news media as the one and only channel for current science communication.*

### Context

Research into the field of science communication has tended to focus on public understanding of science or on the processes of science communication itself, e.g. by looking at science in the media. Even though two recent British studies specifically address how scientists respond to increasing calls for them to become more involved in communicating their research to the public, there is still much to be done with respect to understanding the complex relations between scientists, science communication, and the public understanding of science.<sup>1</sup>

Historically, the relationship between scientists' and the public has been understood in terms of the canonical model of science communication: Scientists alone produce scientific knowledge and then disseminate their findings in order to educate, perhaps even entertain, the wider public, but also to legitimize the pursuit of science socially.<sup>2</sup> Today, this ideal is being challenged from many directions. Some authors have pointed out that the clear demarcation between science, popular science, and what we might think of as the general public is highly contingent and debatable.<sup>3</sup> Others have endeavored to demonstrate the diversity of scientific reporting in the media, including reports on controversial science and scientists own reports of science-in-the-making.<sup>4</sup> Others, again, promote the normative view that scientists ought to become more interactively and reflexively engaged in public debates about science.<sup>5</sup>

Despite the growing awareness that the canonical model fails to explain and guide adequately the relationship between scientists and the public, there is some evidence that for many people, including scientists themselves, the canonical model still serves as a first approximation to good science communication. In one of the British studies of scientists mentioned above, the dominant definition of how to engage with the public was "informing, explaining, promoting understanding (public)".<sup>6</sup> The other British study showed that when asked an open question about the meaning of the term "public understanding of science", none of the scientists in their answer included public dialogue or interacting with the public. Typically, the scientists came up with explanations such as "making sense of scientific research findings", or "informing the public in a way that they can understand about what we are doing".<sup>7</sup>

Consequently, there are two competing notions about how scientists and the public engage, and ought to engage with each other. On the one hand, the canonical model stresses one-directional science

communication from scientists to the public and gives prominence to the public uptake and appreciation of science. On the other hand, the interactive, reflexive model urges more public participation at an upstream stage where science is in the making, so to speak.<sup>8</sup> The latter includes the call for getting scientists more involved in public dialogue.

These two notions are also at play in the national context of this survey, i.e. the new Act on Universities from 2003 that establishes science communication as a third obligation for university scientists on an equal footing with research and teaching.<sup>9</sup> The obligation to communicate science to the public comprises two different types of science communication:

1. The “canonical” obligation is described as an obligation to “disseminate knowledge of scientific methods and results” (§ 2.1)
2. The “interactive” obligation obligates the university – as a central knowledge-based and cultural repository – to “exchange knowledge and competencies with society and encourage its employees to take part in the public debate” (§ 2.3)

The first obligation reflects the canonical understanding of the relationship between science and the public. Centred on scientific knowledge production and dissemination, it appeals to research policy-makers and university administrators as it does scientists. It is easily carried into effect by employing communication officers and by training scientists to communicate their research to the media. The interactive obligation is based on a more complex understanding of the university as knowledge and culture-based and of the relations between universities and society. It might therefore be more difficult to realize for institutions and for individual scientists in particular. Consequently, the survey reported here took the canonical obligation as its point of departure, but more implicitly, also included the interactive obligation.

Following the enactment of the Act on Universities, the Ministry of Science appointed an independent think tank, which was not only to assess Danish science communication, but also to suggest new initiatives. In its final report, the think tank argued that, indeed, more two-way communication between scientists and the public, i.e., more interaction, was needed.<sup>10</sup> Moreover, the think tank suggested allocating 2% of the total research budget in Denmark to science communication, which, depending on the exact interpretation of the choice of words, amounts to a lot of money, up to 13 million euros. Science communicators celebrate both recommendations, whereas politicians and scientists have hitherto been more reluctant to evaluate the call for more two-way interaction and the controversial 2% funding benchmark for Danish science communication.<sup>11</sup>

## Purpose

The purpose of this study was to find out how Danish university researchers within the natural and engineering sciences respond to the “canonical” obligation. We wanted to map their general interest in using different media of science communication as well as their active participation in current science communication. Moreover, we wanted to find out what scientists think about the think tank’s 2% recommendation, and what they believe ought to be done in order to strengthen science communication in Denmark.

## Metode

We used the webbased SurveyXact®-system, developed and marketed by Rambøll Management. The system uses the Internet to handle questionnaire design, respondent lists, e-mail distribution, data collection and data analysis. We investigated scientists employed at six national universities, all of which offer natural and technical sciences: University of Copenhagen, University of Aarhus, University of Aalborg, University of Roskilde, the Technical University of Denmark, and the University of Southern Denmark. Since virtually all university employees have easy access to the Internet and e-mail, there are no methodological problems in using an Internet-based questionnaire rather than other methods such as telephone-interview or ordinary mail.<sup>12</sup>

We had access to e-mail lists from the university-based popular science magazine *Aktuel Naturvidenskab* (Current Science).<sup>13</sup> The magazine is distributed to all of the scientists at the six universities mentioned above, and the editors have quite extensive e-mail lists. We also contacted the

	Danish research statistics, 2003 (natural sciences)	Danish research statistics, 2003 (technical sciences)	Our survey
Persons under 35 years of age	32%	35%	33%
Women	23%	15%	17%
Professors	10%	11%	13%
Senior lecturers	35%	33%	45%
Lecturers	16%	15%	14%
PhD-students	30%	33%	21%

**Table 1.** Characteristics of the Danish population of researchers taken from the Danish research statistics (2003) and from our survey.

faculties concerned and gained access to their central e-mail lists. Besides that, we supplemented the lists with e-mail addresses retrieved from the department home pages. In total, we gained access to 2,719 qualified and usable e-mail-addresses, which made up our sample of scientists.

The survey dealt with Danish scientists and the communication of science to the Danish public. We therefore chose to formulate the questionnaire in Danish only. We wanted to find out about the scientists' attitudes towards and interest in science communication as defined by the canonical obligation of the Act on Universities. Moreover, we were interested in learning more about their normative views on science communication in the news media, on what the kind of science communication the universities ought to conduct, and on the 2% recommendation of the think tank (see above). The questions were designed using questions from a similar questionnaire of Danish researchers in the humanities and from a quantitative analysis of British scientists based on face-to-face interviews.<sup>14</sup> Where appropriate, we modified the questions to fit our sample and the national context of our survey, see above.

The validity of the questionnaire was tested by the editorial board of *Aktuel Naturvidenskab* in September-October of 2004 (16 scientists were asked, 10 answered). We used their answers to correct factual flaws in the questionnaire, to modify a few of the questions and to correct all of the questions for potential misunderstandings due to wording.

The survey itself was made in two stints: in November 2004 at the Faculty of Natural Sciences of Aarhus University and in March-May 2005 at the five remaining universities. We distributed an introductory e-mail, which explained the purpose of the survey, referred to the national context of the survey in the form of the new Act on Universities, and provided our contact information. Furthermore, the e-mails contained a link to the questionnaire that would open in a new window. For security reasons and in order to trace each respondent individually, each scientist was given a unique identification number. The questionnaire took 10-15 minutes to fill in.

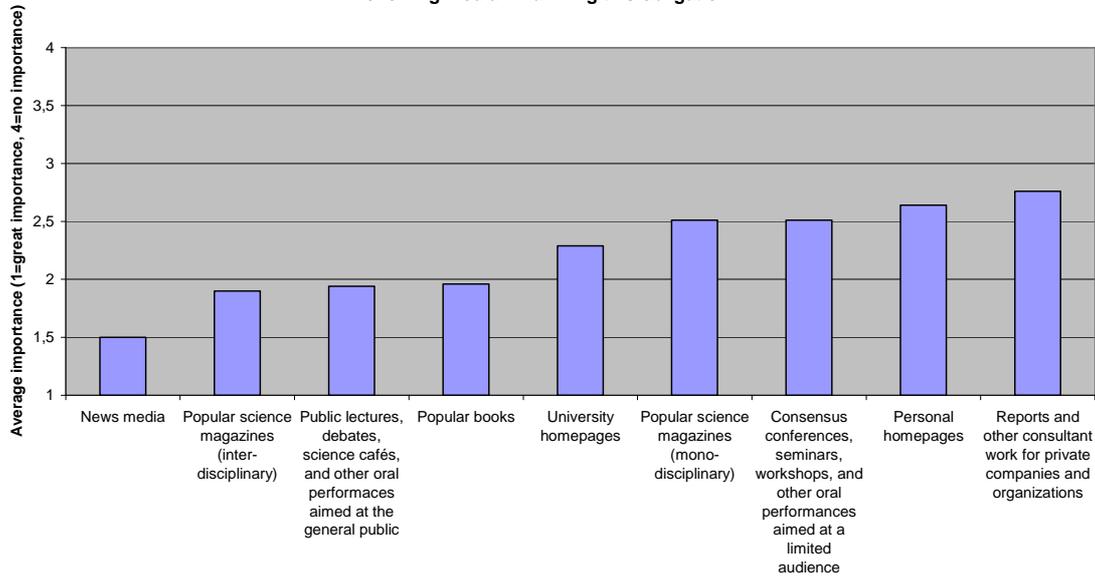
All the recipients were given two weeks to complete the questionnaire. After 10 working days we sent a follow-up reminder to those that still had not returned the questionnaire. Following the original deadline, we gave a further three days to those that were yet to answer. In total we received 1,038 completed forms and 142 partially completed, which corresponds to a response rate of 38.2% (calculated as Response Rate 1 as determined by the definitions of American Association for Public Opinion Research).<sup>15</sup>

Before presenting the results of the survey, we would like to briefly assess the quality of our data. We do not know the exact number of scientists who work at the faculties of natural and engineering sciences of the six universities that were part of the survey. We do, however, have access to Danish research statistics, which includes information about Danish scientists at all of the 12 universities of the country in 2003.<sup>16</sup> Table 1 shows a comparison between the Danish research statistics and our sample.

As table 1 shows, our respondents resemble the national population of researchers in 2003, when compared to the available "demographic" variables. Our sample has, however, a slight over-representation of senior lecturers and an under-representation of PhD students. We have attempted to adapt all subsequent results to this imbalance through a simple weighting of our data, and no difference between the weighted and un-weighted data is to be discerned. This imbalance thus has no qualitative bearing on our results.

We will assume, however, that our survey has a certain over-representation of scientists that already hold a positive view of science communication. The assumption is based on the idea that such scientists are more inclined to make an active effort to answer the questions. However, it is not possible to say anything about the extent of this over-representation. The assumption will therefore be used very cautiously in the following analysis.

**Chart 1: According to the Act on Universities, it is the obligation of the university to "disseminate knowledge of scientific methods and results". How would you evaluate the importance of the following media in fulfilling this obligation?**



**Chart 1.** Different media ranked by the respondents' average evaluation of their importance to the universities. The Y-axis indicates the average importance of the media concerned, determined by the following scale: 1 = great importance; 2 = some importance; 3 = little importance; 4 = no importance. Please note that the lower the average score is, the greater the importance of the media in question.

## Results

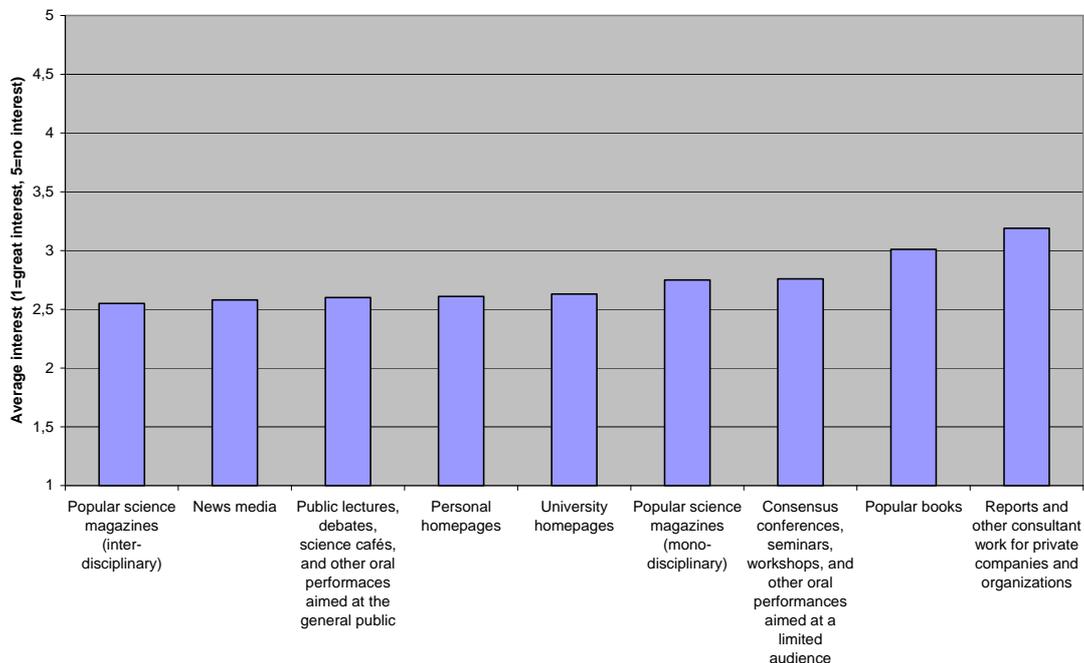
When it comes to fulfilling the new, "canonical" obligation of the Act on Universities, our respondents clearly believe the news media to be the most important, see chart 1. (The question in the heading is the question posed to the scientists.)

The chart indicates that the respondents rank the media by their potential diffusion and the size of their target group. The four highest ranked media all aim at the broader public, while more targeted media rank the lowest. The same tendency is found when we compare the media in pairs. Public lectures, debates and science cafés are for example deemed to be more important than other kinds of oral presentations with a more restricted audience (Consensus conferences, workshops etc.). In the same way, inter-disciplinary popular science magazines are held to be more important than similar publications, which only deal with a single discipline. The fact that the respondents view the news media as being the most important, when it comes to disseminating knowledge about the results and methods of science, may thus tentatively be ascribed to the respondents' (correct) assessment that the news media has the widest distribution.

The news media also score well when the respondents have to indicate their own, personal interest in disseminating science, see chart 2.

We note small variations among the media when comparing with chart 1. Apparently, our respondents do not take particular interest in writing popular books in order to disseminate knowledge to the public, whereas such books are deemed to have a relatively great importance for the universities (chart 1). Inversely, the respondents are interested in using personal home pages for science communication, yet the same medium is viewed as relatively being unimportant for the science communication of the universities. A part from these small variations, chart 2 exhibits the same tendency as chart 1: the broader media are of greater interest to the respondents than the more targeted ones.

Chart 2: As a scientist, how interested are you in contributing to science communication in the following media?



**Chart 2.** Different media involved in science communication ranked by the respondents' average interest in contributing to them. The Y-axis indicates the average level of agreement with the statements, determined by the following scale: 1 = great interest, 2 = some interest; 3 = neither/nor; 4 = little interest, 5 = no interest. Please note that a low average score indicates great interest.

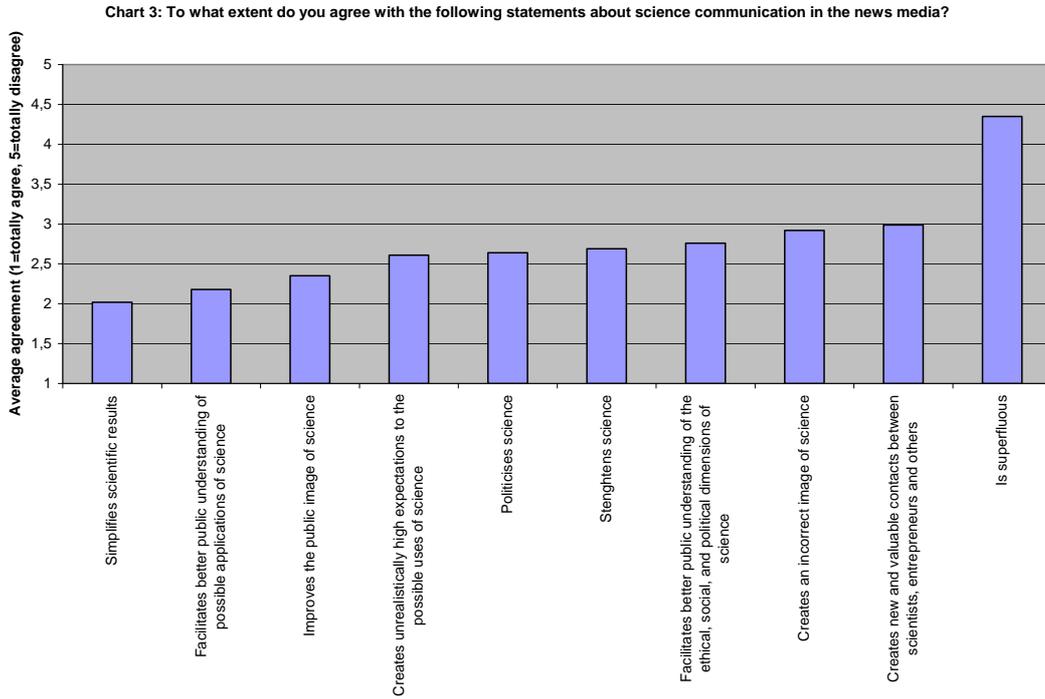
We were somewhat surprised by the great support among our respondents for science communication through the news media. We did, however, ourselves estimate that the news media play an important role in fulfilling the universities obligation to communicate, and, so, we asked them to express their level of agreement with a series of statements concerning the news media's science communication, see chart 3.

Not surprisingly, the respondents by and large agreed with the statement that the news media simplify scientific results. Inversely, they strongly disagreed with the statement that science communication in the news media is superfluous. This last result is in accordance with the high priority that the respondents apply to the news media when it comes to their own and the universities' science communication.

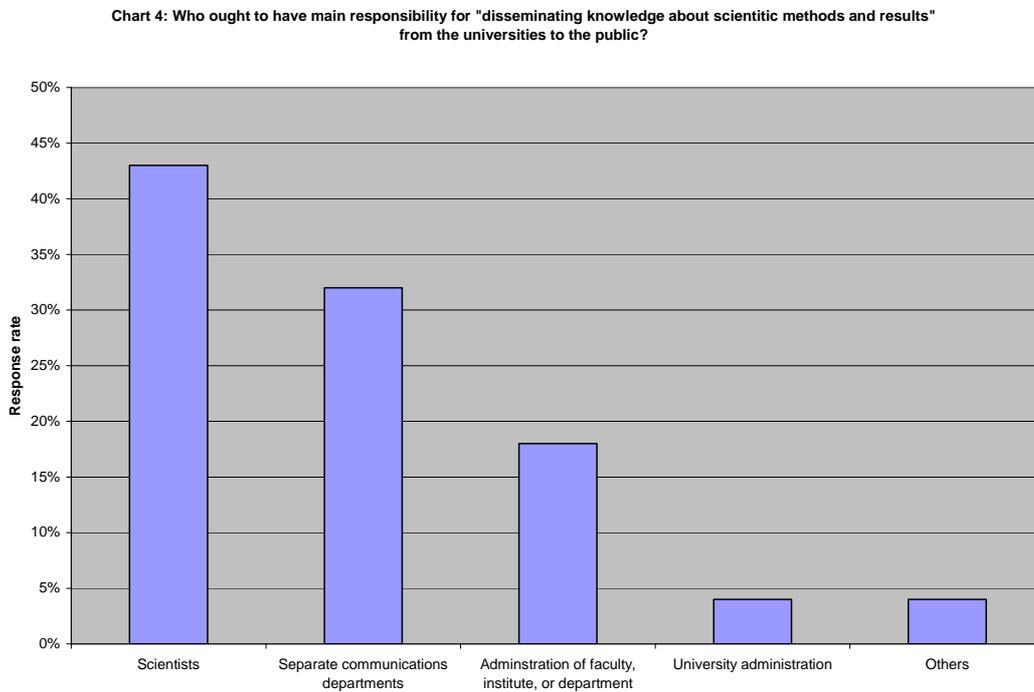
Generally, the respondents demonstrate a rather complex and nuanced perception of science communication in the news media. For example, our respondents tend to agree with the statement that science communication facilitates a better understanding of the possible uses of science, but at the same time they agree with the statement that science communication in the news media creates unrealistically high expectations with respect to the uses of science. In the same way, it is widely accepted that the news media's science communication contributes both to politicize and to strengthen science. Such statements do not necessarily contrast. The respondents probably find that science communication in the news media is broad-ranging and can be both positive and negative, as seen from the point of view of science.

Apparently, the respondents are not too worried about the news media producing an incorrect image of science in the public. On the contrary, it is widely agreed that the media contributes to improving the image of science. It seems that the respondents do not view the media as very critical of science, which might be surprising, knowing that journalist often feel a need to be critical of their subjects.<sup>17</sup>

The new Act on Universities law says nothing about who is to be responsible for the new communication obligation of the universities. Therefore, we were interested in finding out where our respondents would place such a responsibility, see chart 4.

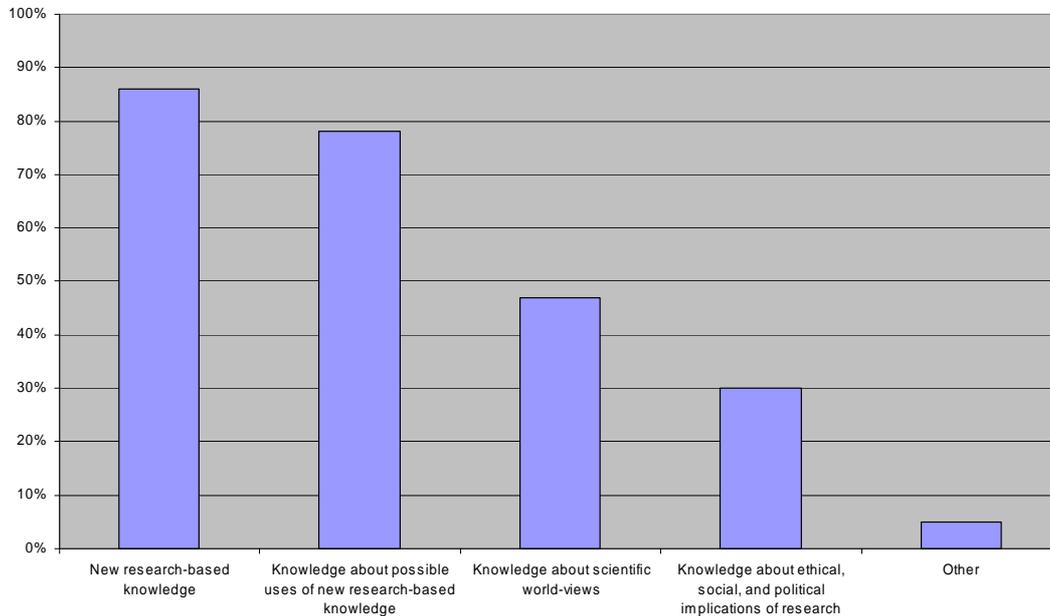


**Chart 3.** Average level of respondents’ agreement with a series of statements concerning science communication in the news media. The Y-axis indicates the average level of agreement with the statements, determined by the following scale: 1 = totally agree, 2 = partially agree, 3 = neither agree nor disagree, 4 = partially disagree, 5 = totally disagree.



**Chart 4.** Placement of responsibility for the new university obligation to disseminate knowledge of scientific methods and results. Only one answer can be given.

**Chart 5: What kinds of knowledge ought to be disseminated from the universities to the general public?**



**Chart 5.** Contents of the “canonical” science communication. Multiple answers allowed.

Nearly half of the respondents (43%) find that the scientists themselves ought to handle the universities obligation to report scientific results. 54% would prefer for the responsibility to be placed elsewhere. Many of the almost 4% that chose *other options* specified that they would prefer that the scientists equally shared the responsibility with a communications staff, placed in separate communications departments.

We were also interested in finding out what respondents believe that the universities ought to report to the public. Chart 5 shows the answers.

The vast majority of the respondents (86%) hold that the universities should communicate knowledge concerning new results of science. Also knowledge about possible uses of these results is given a high priority (78% of all respondents). At a secondary level the scientific view of the world is found (47%), while 30% of the respondents find that the universities should communicate knowledge about the ethical, social and political implications of science. This result must be seen in the light of the fact that we asked explicitly about the canonical obligation to science communication, which, as mentioned, is about diffusing “knowledge of the results and methods of science”.

We also mapped our respondents’ participation in a long series of different media involved in science communication, see chart 6.

70-80% of all respondents have contributed to science communication on the Internet, while little more than half have participated in science communication in the news media. The lowest ranked media are the broad-ranging publications such as inter-disciplinary publications and popular books. Respectively, 59% and 75% of the respondents indicated that they have never participated in this type of science communication.

Finally, we were interested in finding out how our respondents view the recommendation of the think tank to allocate as much as 2% of the total research funding to communication activities. Chart 7 shows the answers. Chart 8 shows how the respondents would prefer using such funding.

Chart 6: When did you last contribute to science communication in the following media?

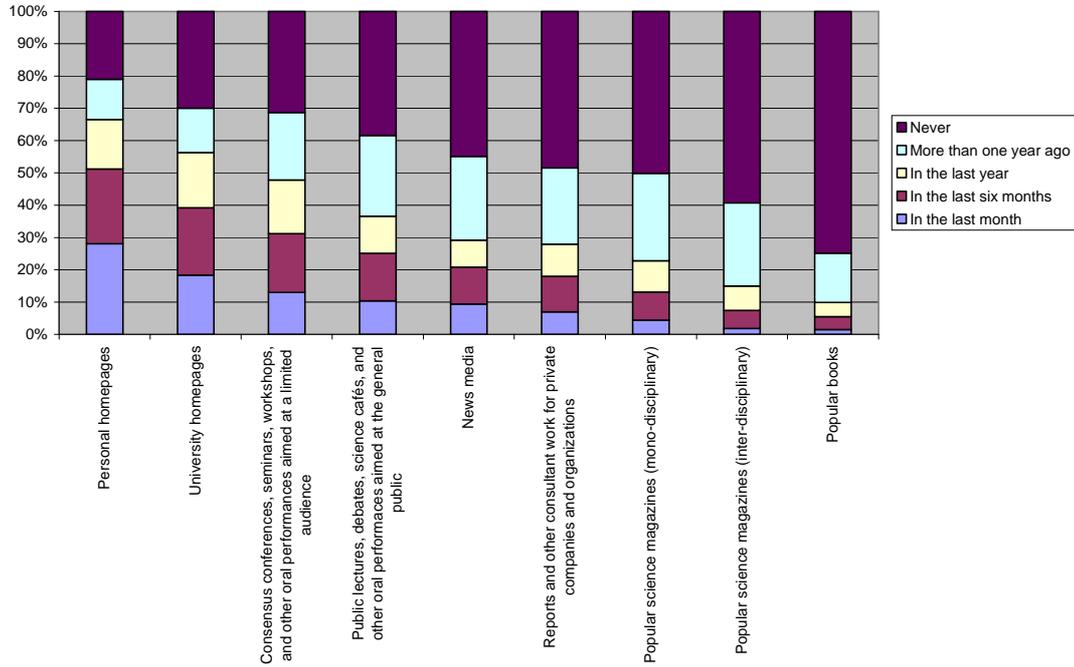


Chart 6. Participation in the different media involved in science communication.

Chart 7: To what extent do you agree with the 2% recommendation of the think tank?

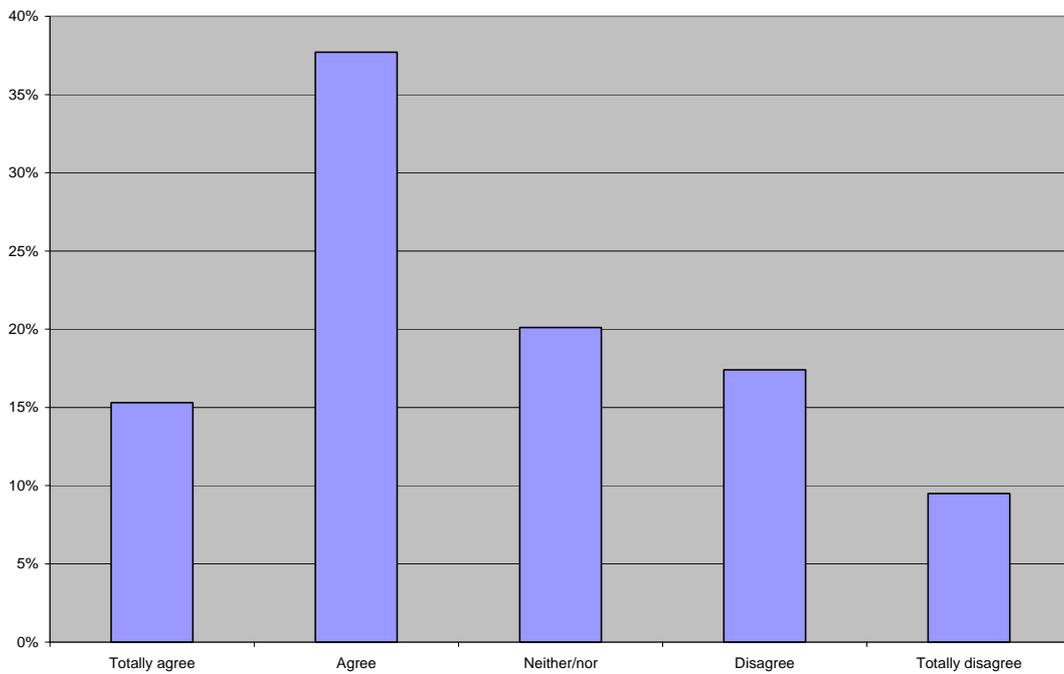


Chart 7. Views of the 2% recommendation of the think tank.

Chart 8: If you were to administer 2% of the total research budget for science communication, what would you spend the money on?

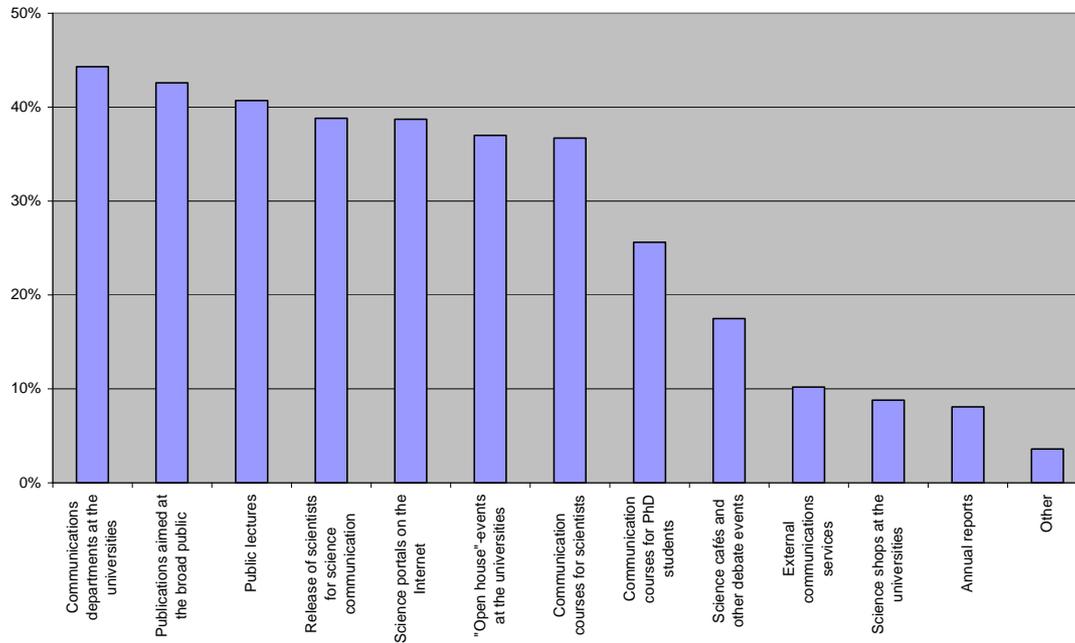


Chart 8. Priorities in spending. Maximum 4 answers.

53% of the respondents either agreed or totally agreed with the recommendation of the think tank, while 27% either disagreed or totally disagreed. This indicates a certain ambition among the respondents to increase efforts in science communication. We have to be very careful in simply transposing this conclusion to the full population of Danish scientists, because our respondents, in all likelihood, hold a positive view of science communication compared to those who did not return the questionnaire, as discussed above.

It is quite interesting to note, however, that within the uncertainties attached to these figures the support of the 2% recommendation is independent of all other variables in the analysis. For example, respondents of all ages, of both sexes and from all the disciplines involved all expressed the same amount of support for the recommendation. The same applies if the answers are distributed according to general interest in science communication (chart 2) and participation in science communication (chart 6). With respect to assigning greater priority to science communication in the future, it doesn't matter whether the scientists are active in communicating their science to the public, or whether they take a general interest in science communication.

## Conclusions

Our conclusion is split in three: Firstly, we will compare our results with the above mentioned British survey, carried out between December 1999 and March 2000. Subsequently, we will draw into our considerations another Danish survey from 2005 that deals with scientists from all disciplines, with communications staff who work with science communication, and with a representative sample of the population. Finally, we will hint at some possible tendencies in scientists' view of science communication and their active participation in it.

The British survey concludes that the majority of scientists see it as their task to communicate science to political decision makers and to the broader public.<sup>18</sup> That goes for new research results as well as the

social and ethic implications of science. In our survey we also note that the respondents tend to take an interest in science communication, cf. chart 2. The communication of social and ethic implications of science, however, is not widely supported by our respondents. This is probably because the university law's canonical obligation to communicate science only to a very limited extent incites this type of science communication.

In the British survey as many as 69% of all respondents answered that scientists should be responsible for the communication of social and ethic implications of science.<sup>19</sup> In comparison, only 43% of our respondents held that scientists should be responsible for fulfilling the canonical obligation to science communication of the universities. The two figures are not directly comparable. In spite of that, it is striking that so few of our respondents are willing to take the responsibility for science communication, even when it comes to disseminating knowledge of scientific methods and results. Not the least when it is considered that our sample probably has a certain overrepresentation of scientists that are already interested in science communication.

The result might be due to the fact that scientists have a heavy workload with research and teaching and hence would like to "outsource" the public communication of science to communications departments. In the above mentioned British survey a majority (60%) of the respondents stated that they do not have time to communicate their results to the public. Approximately the same percentage (56%) also mentioned, however, that they do not even have the time to do research.<sup>20</sup> The lack of will to take on the responsibility for science communication among our respondents may also be due to a professional assessment that communication staff is more professionally fit to handle science communication than the scientists themselves. One of our respondents wrote: "It would be very foolish to impose yet another task on scientists, and even one for which they are not even qualified. I believe that professional science communicators and public relations ought to be put in charge of communicating science from the university to the public."

The British scientists displayed an ambiguous view of science communication through the news media. On one hand, only 7% found the news media to be the most important target-group for their science communication.<sup>21</sup> On the other hand, TV, radio and newspapers are seen as the most effective means of communicating science to the public.<sup>22</sup> Our respondents also held a positive view of science communication in the news media, however mixed with some reserve.

On the one hand, our respondents indicated that the news media are the most important media for the universities when it comes to fulfilling the canonical obligation to disseminate knowledge of scientific methods and results. The respondents also exhibited an interest in contributing personally to science communication in the media. On the other hand, the respondents agreed with both positive and negative statements concerning the role of the news media in science and research communication. Our results and the results of the British survey are clearly a sign of how very complex science communication in the news media is and thus also of the difficulty of expressing coherent views on the matter.

In any case, our survey and the British one both indicate that scientists do not hold negative views of the news media's broad science communication, but, on the contrary, critically and constructively evaluate the news media as a very important channel for communicating with the public. In other words, scientists are happy to appear in the news media, and seem to be well aware of both the dangers and the benefits of reporting science through this medium.

Evidently, this desire of scientists to appear in the news media entails a series of risks in the long term. Another Danish survey of science communication undertaken in 2005, based on focus group interviews, an Internet survey, and an opinion poll focuses on just such risks.<sup>23</sup> The survey points to a possible unholy alliance between scientists, who are under strong pressure to deliver more science communication, and journalists, who chase more scientific experts and more infotainment. If scientists and journalists uncritically collaborate so as to satisfy employers, commercial interests and the broad public, the increasing amount of science communication can have the following unfortunate side effects:

- Devaluation of the status of science: If scientists begin to appear in the media as commentators of matters unrelated to their own research field, and thus (ab)use their scientific status, their credibility might be lost.<sup>24</sup> In the above mentioned survey, approximately one-third of the scientists, journalists and private individuals that were interviewed, held the view that there are "too many scientists that simply present their own views in the media".<sup>25</sup>

- Simplification of science: A vast majority of the scientists that were investigated hold the view that the news media simplify the results of science. (This result is in accordance with our own results, which show that our respondents tend to agree with the statement that the news media simplify the results of science.) Furthermore, the survey demonstrates that 70% of the participating scientists, journalists and private individuals find that journalists lack the skills needed to communicate science.
- Prostitution of science: The authors of the report express the view that scientists are tempted to use the news media to make their own science more visible, with a view to attracting further external funding. This conclusion is not directly documented, but is a consequence of the increasing external funding of science and the increased access of scientists to the news media in many different roles.

Our own survey indicates that the scientists are well aware of the possible risks of an increase in science reporting in the news media and have a nuanced and critical view of this type of science communication, cf. chart 3. The British survey in mention further shows how three quarters of the scientists feel able to communicate their own research, whereas slightly less than half of them feel that that they are able to communicate the social and ethic implications of their research. Furthermore, the report concludes that a need exists for a series of concrete measures and strategic efforts on behalf of the political decision makers, fund holders, science institutions and individual scientists.

Our survey shows that many scientists would be interested in allocating substantial means to science communication (up to 2% of the entire budget for research), and that they also hold views as to which initiatives are desirable or needed. According to our respondents, a broad focus on the many different kinds of media and activities involved in science communication is desirable, as a supplement to science communication in the news media. They may, therefore, in actuality subscribe more to the interactive obligation also contained in the Act on Universities than to the canonical one.

*Translated by Anders Jensen*

## Notes and references

- <sup>1</sup> The Royal Society, *Survey of factors affecting science communication by scientists and engineers*, The Royal Society, Research Councils UK, and the Wellcome Trust, London, June 2006. Retrieved 12 December 2006, available at: <<http://www.royalsoc.ac.uk/page.asp?id=3180>>; Market & Opinion Research International (MORI), *The Role of Scientists in Public Debate*, The Wellcome Trust, London, 2001. Retrieved 12 December 2006; available on: <[http://www.wellcome.ac.uk/doc\\_WTD003429.html](http://www.wellcome.ac.uk/doc_WTD003429.html)>. Other studies addressing the issue of scientists and science communication include: Lisa H. Weasel and Eric Jensen, "Language and values in the human cloning debate: a web-based survey of scientists and Christian fundamentalist pastors," *New Genetics and Society*, 24 (1), April 2005, p. 1-14; Svein Kyvik, "Popular Science Publishing and Contribution to Public Discourse among University Faculty," *Science Communication*, 26 (3), March 2005, p. 288-311; Nora Jacobsen, Dale Butterhill and Paula Goering, "Organizational Factors that Influence University-Based Researchers' Engagement in Knowledge Transfer Activities," *Science Communication*, 25 (3), March 2004, p. 246-59. Moreover, two recent Danish studies of science communication that focus, respectively, on researchers in the humanistic disciplines and on scientists more broadly are: Gitte Gravengaard, *Undersøgelsesrapport for undersøgelsen: Humanistiske forskere og forskningskommunikation*, October 2003. Retrieved 12 December 2006, available (in Danish) at: <<http://www.gravengaard.dk/forskereogmedier/PDF/Undersøgelsen%20-%20version%202.pdf>>; Danmarks Pædagogiske Universitet and Mandagmorgen, *Jagten på det troværdige universitet. Muligheder og risici i fremtidens forskningskommunikation*, November 2005. Retrieved 12 December 2006; available (in Danish) at: <[http://www.mm.dk/filer/jagten\\_pa\\_det\\_troværdige\\_uni.pdf](http://www.mm.dk/filer/jagten_pa_det_troværdige_uni.pdf)>.
- <sup>2</sup> On the canonical, if not dominant model of communication, see Steven Shapin, "Science and the Public." In: R.C. Olby et al. (eds.), *Companion to the History of Modern Science*, London, Routledge, 1990, p. 990-1007; Stephen Hilgartner, "The Dominant View of Popularization: Conceptual Problems and Political Uses," *Social Studies of Science* 20 (3), p. 519-39.
- <sup>3</sup> Peter Broks, *Understanding Popular Science*, Maidenhead, Open University Press, 2006; Felicity Mellor, "Between Fact and Fiction: Demarcating Science from Non-Science in popular Physics Books," *Social Studies of Science*, 33 (4), August 2003, p. 509-583; Thomas F. Gieryn, *Cultural Boundaries of Science: Credibility on the Line*, Chicago and London, University of Chicago Press, 1999; Jane Gregory and Steve Miller, *Science in Public. Communication, Culture, and Credibility*. London, Perseus Publishing, 1998, esp. p. 242-250.
- <sup>4</sup> Some recent contributions include: M.C. Nisbet and M. Huges, "Attention Cycles and Frames in the Plant Biotechnology Debate: Managing Power and Participation through the Press/Policy Connection," *Harvard International Journal of Press-Politics*, 11 (2), Spring 2006, p. 3-40; M. Hutchins, "Death at the zoo: The media, science, and reality," *Zoo Biology*, 25 (2), March-April

- 2006, p. 101-115; Martin W. Bauer, Kristina Petkova, Pepka Boyadjieva, and Galin Gornev, "Long-Term Trends in the Public Representation of Science Across the 'Iron Curtain'," *Social Studies of Science*, 36 (19), February 2006, p. 99-132; L.F. Stephens, "News Narratives about Nano S&T in Major US and non-US Newspapers," *Science Communication*, 27 (2), December 2005, p. 175-199; M. Horst, "Cloning sensations: mass mediated articulation of social responses to controversial biotechnology," *Public Understanding of Science*, 14 (2), April 2005, p. 185-200; J.B. Corbett and J.L. Durfee, "Testing Public (Un)certainly of Science: Media Representations of Global Warming," *Science Communication* 26 (2), December 2004, p. 129-151.
- <sup>5</sup> For example, Brian Wynne, "Public Engagement as a Means of Restoring Public Trust in Science – Hitting the Notes, but Missing the Music?" *Community Genomics*, 9 (3), May 2006, p. 211-220; Helga Nowotny, Peter Scott and Michael Gibbons, *Re-Thinking Science: Knowledge and the Public in an Age of Uncertainty*, London, Polity, 2001.
- <sup>6</sup> 34% of the respondents preferred this definition out of 23 answers. No. 2 and 3 on the list, respectively, were "implications, relevance, utility of research, value of science" (15%) and "listening, understanding public, involving people in science, science-based debates, science-based decisions" (13%). The Royal Society, op. cit., p. 22.
- <sup>7</sup> Market & Opinion Research International (MORI), op. cit., p. 9.
- <sup>8</sup> Phil MacNaghten, Matthew B. Kearnes, and Brian Wynne, "Nanotechnology, Governance, and Public Deliberation: What Role for the Social Sciences?" *Science Communication*, 27 (2), December 2005, p. 268-291.
- <sup>9</sup> Videnskabsministeriet, *Bekendtgørelse af lov om universiteter (Universitetsloven)*, Copenhagen, Ministry of Science, 2006. Retrieved 13 December 2006; available (in Danish) at: <<http://videnskabsministeriet.dk/site/forside/lovstof/gaeldende-love-og-regler/Bekendtgørelse-af-lov-om-universiteter-Universitetsloven>>. English version, retrieved 13 December 2006; available at: <<http://videnskabsministeriet.dk/site/frontpage/acts/act-on-universities>>. For more about the current Danish context of science communication, see: K.H. Nielsen, "Between understanding and appreciation. Current science communication in Denmark," *JCOM*, 4 (4), 2005. Retrieved 13 December 2006; available at: <<http://jcom.sissa.it/archive/04/04/A040402/>>.
- <sup>10</sup> Videnskabsministeriets tænketank vedrørende forståelse for forskning, *Forsk og fortæl!*, May 2004. Retrieved 12 December 2006; available (in Danish) at <<http://videnskabsministeriet.dk/site/forside/publikationer/2004/forsk-og-fortael/index.htm>>.
- <sup>11</sup> C. Nielsen and P. Rystrom, "100 millioner til forskningskommunikation," *Kommunikatøren*, nr. 6, December 2005. Retrieved 13 December 2006; available (in Danish) at: <<http://www.kommunikationsforening.dk/a690029>>.
- <sup>12</sup> S.K. Orr, "New Technology and Research: An Analysis of Internet Survey Methodology in Political Science," *PS: Political Science and Politics*, 38 (2), April 2005, p. 263-7.
- <sup>13</sup> The homepage of the magazine (in Danish), retrieved 2 March 2006, available at: <<http://www.aktuelnat.au.dk/>>.
- <sup>14</sup> Gravngaard, 2003, op. cit.; Market & Opinion Research International (MORI), 2001, op. cit.
- <sup>15</sup> American Association for Public Opinion Research, *Standard Definitions. Final Dispositions of Case Codes and Outcome Rates for Surveys*, 2006. Retrieved 3 March 2006; available at: <[http://www.aapor.org/pdfs/standarddefs\\_4.pdf](http://www.aapor.org/pdfs/standarddefs_4.pdf)>.
- <sup>16</sup> Dansk Center for Forskningsanalyse, *Forskning og udviklingsarbejde i den offentlige sektor – Forskningsstatistik 2003*, updated 21 februar 2006. Retrieved 3 March 2006; available (in Danish) at: <<http://www.forskningsanalyse.dk/OF2003/Tabelsamling.pdf>>.
- <sup>17</sup> For different analyses of the relationship between scientists and journalists, see: D. Nelkin, *Selling Science. How the Press Covers Science and Technology*, revised edition, New York, W.H. Freeman and Company, 1995; H.P. Peters, "The interaction of journalists and scientific experts: co-operation and conflict between two professional cultures," *Media, Culture & Society* 17, 1996, p. 31-48.
- <sup>18</sup> Market & Opinion Research International (MORI), 2001, op. cit., sp. 21.
- <sup>19</sup> Ibid, p. 26.
- <sup>20</sup> Ibid, p. 22.
- <sup>21</sup> Ibid, p. 28.
- <sup>22</sup> Ibid, p. 38.
- <sup>23</sup> Danmarks Pædagogiske Universitet and Mandagmorgen, 2005, op. cit., p. 10.
- <sup>24</sup> In the Danish context, it has been shown that social scientists increasingly appear as commentators of matters outside their field of specialization, see: E. Albæk, P.M. Christiansen, and L. Togeby, "Experts in the mass media: Researchers as sources in Danish daily newspapers, 1961-2001," *Journalism and Mass Communication Quarterly* 80, 2003, p. 937-48.
- <sup>25</sup> Danmarks Pædagogiske Universitet and Mandagmorgen, 2005, op. cit., p. 11.

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