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Publishing Strategies in Transformation?

Results of a study
on publishing habits and information
acquisition with regard to open access

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Summary

In 2004 the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) commissioned a study on the major factors that determine the publishing behaviour of DFG-funded researchers and their means of accessing scientific information, particularly publications that are available for free over the internet. This report presents the results of this survey. It provides valuable insights into the transformation taking place in the publishing landscape, an issue that has been much discussed, but not adequately documented with empirical data. The study also provides those actively involved in this transformation an important basis for planning. More than one thousand researchers from all scientific disciplines took part in the survey. The main results are summarised below.

1. Assertions on the awareness and use of open access publication instruments can only be interpreted based on general, discipline-specific publishing practices. For this reason, the first step consisted of analysing the common publishing paradigms for the four scientific disciplines surveyed. The natural and life sciences are characterised by journal publications, in contrast to the humanities and social sciences, in which a book culture is predominand. Researchers in the engineering sciences prefer to publish their results in conference proceedings. In general German science shows a marked trend towards internationalisation, which is reflected by the predominant use of English for publications in the majority of the disciplines surveyed. In the humanities and social sciences, however, in which language itself is a subject of research, the dominance of English is naturally less widespread.

2. Across all scientific disciplines, very few researchers so far actively publish in open access. Of all respondents, only about one in ten had ever published in an open access journal. Even the distribution of freely accessible preprints on the internet, common practice in some subjects, does not occur frequently according to the respondents. Slightly more frequent was the practice of publishing articles in open access on the internet after they had already been published elsewhere. All in all, however, the number of open access publications available to users in open access is still very low.

3. In contrast to the low rate of publishing activity in open access, a majority of respondents across all scientific disciplines are in favour of more active promotion of open access by the DFG. Of these, young researchers in the natural, life and engineering sciences are more strongly in favour of funding open access publications than their more established colleagues. Conversely, in the humanities and social sciences, in which further qualifications (such as the habilitation or a "second book") still play an important role, established academics are more in favour of the DFG providing support for open access than their younger colleagues.

4. The reservations expressed about open access publications are typical of electronic publications. In particular the issues of quality assurance, long-term availability and frequency of citation of free publications are questioned. These doubts do, however, begin to recede in proportion to the amount of experience respondents had with electronic publications in general and open access publications in particular.

6. The willingness of researchers to use their research budgets to make their publications available free of charge is proportional to the expenditure that scientists already have to finance in order to publish their research results through conventional channels. The life scientists show the most, and the humanities scholars and social scientists the least willingness to pay author fees for publications in open access.

6. According to the respondents, the publication grant", which since 2001 can be applied for directly as part of a DFG-funded project, is saved up in the humanities and social sciences above all to pay the costs of preparing monographs for publication. In the life, natural and engineering sciences the majority of the publication funds are used to defray the costs of publishing in conventional journals. Only in exceptional cases is the publication grant also used to finance open access publications; only the natural scientists used their resources more frequently to publish their research results in open access publications.

7. The researchers' proposals of how the DFG could promote open access were mainly directed towards measures for intensifying the debate about free access publications, measures for ensuring the quality of open access journals, and towards technical, legal and organisational support of secondary open access publication of articles already published through conventional media.

1. Context, motivation and objective

1.1 New tendencies in scientific publishing

The growing internationalisation of science and research has increased the need for access to scientific information to be independent of time and location. The rapid development and spread of electronic means of communication have opened up new ways for scientists to publish and access research results. On the internet scientific studies can be made accessible to a worldwide readership within a short period of time and often with little effort. According to Stephen Hitchcock [1], since the mid-1990s electronic journals have become of increasing interest to publishing houses wishing to develop subject-specific, substantial banks of information on the internet by digitalising the back issues of their journals. Access to these sources of information has been and is only provided in return for (sometimes) large fees, which have had to be paid out of research budgets or from the budgets of libraries. Oftentimes the research results were financed by public funds in the first place. This leads to the paradoxical situation in which publications that could not have been produced without public money have to be paid for a second time with state funds; at the same time the costs of buying and providing scientific literature in university libraries and other institutions have been rising rapidly over the last ten years. In response to this paradox, which can be observed worldwide and which has led to the cancellation of journal subscriptions and the purchase of fewer monographs by libraries [2], scientists have coined the slogan "Science back to the scientists", which sums up the ideological background of the open access movement.

Paradox: publicly funded research has to be made accessible to the scientific community with the help of public funds

Open access aims to improve access to the results of scientific research by making them freely accessible over the internet. Access is free because authors store the results of their work "in a suitable electronic format on at least one archive server that has appropriate technical standards and is accessible online", thereby publishing the work and granting permission to reuse the publication for any reasonable purpose provided that they correctly acknowledge authorship [3]. There are two main types of open access publishing [4]: the "golden road to open access" is a model in which authors pay their own fees to publish their articles in refereed online journals; the author fees are used to pay the publishing costs so that users can read the publications on the internet without having to pay any licence fees themselves [5]. The second model is the "green road to open access", a process whereby peerreviewed re search results that have already been

Open access as an alternative?

1. *Hitchcock, Stephen Meirion: Perspectives in Electronic Publishing: Experiments with a New Electronic Journal Model. Doctorate Thesis, January 2002, pp. 42-53; http://www.ecs.soton.ac.uk/~sh94r/Jnls-research/thesis/thesis-text.pdf. See also Keller, Alice: Elektronische Zeitschriften: Entwicklungen in den verschiedenen Wissenschaftszweigen. in: zeitenblicke 2/2003,2 [22.10.2003], URL: http://www. zeitenblicke.historicum.net/2003/02keller.htm, section 8 ff.*
2. *Cf. e.g. Hochschulrektorenkonferenz (German Rectors' Conference): Zur Neuausrichtung des Informations- und Publikationssystems der deutschen Hochschulen. HRK: Bonn 05. November 2002. http://www.hrk.de/de/beschluesse/109_247.php. See Wissenschaftsrat (German Science Council): Empfehlungen zur digitalen Informationsversorgung durch Hochschulbibliotheken. Greifswald: German Science Council, 13 July 2001, p.16. (Drs.4935/01). Cf. also: Association of Research Libraries: ARL Statistics. Monographs and Serial Costs in ARL Libraries. 1986-1999. Washington: ARL 1999. http://www. arl. org/stats/arlstat/graphs/1999t2.html.*
3. *Translated from the German version of the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, see http://www.zim.mpg.de/openaccess-berlin*
4. *The many other varieties of open access publishing, whose testing is mainly connected with the search for practicable business models, will not be further discussed here. For the most well known of these, see e.g. Harnad, Stevan: The Access/Impact Problem and the Green and Gold Roads to Open Access. in: Serials Review 30/4 special issue: Open Access (2004), pp. 310-314.*
5. *A working group from Lund University Libraries maintains a directory of the most important open access journals at http://www.doaj.org/; at the end of April 2005 this directory listed 1,532 journals whose peer-reviewed articles are available free of charge on the Internet.*

published elsewhere are published as a secondary publication – mostly in institutional or discipline-specific repositories – for free access on the internet. Because these works are made available by the authors themselves, the term "self-archiving" has been adopted to describe this approach [1].

The statements and initiatives that bear the term "open access" serve as a clear indication of the increasing importance of this movement [2]. These statements include the Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities, which is of particular significance to the German scientific landscape. The Berlin Declaration was signed in October 2003 by representatives of Germany's major research organisations, including the Deutsche Forschungsgemeinschaft, the Max Planck Society, the Helmholtz Association, and the Leibniz Association, all of whom committed themselves to promoting publishing practices based on the principle of open access.

1.2 Study objectives

Survey of publishing habits and means of accessing information with regard to open access

After signing the Berlin Declaration, the DFG's statutory bodies had to decide how the DFG could increase its efforts to promote open access. Because little reliable information existed about either the relevance or the impact of open access publications in the different scientific disciplines, the DFG commissioned a survey in order to determine the main factors that influence publishing habits and the means of accessing information, as well as the status attributed to such publications. The aim of the study was to establish the willingness of DFG-funded researchers to make their work available in open access, including both primary publications in open access journals and secondary publications of works already published elsewhere. In addition, they also wanted to test the readiness to use scientific results published in this way within each specialist scientific community. The DFG would use the results of the survey to assist it in deciding whether and in what form it would give researchers more encouragement and support to publish scientific work in open access.

In order to determine the readiness for online publishing and acquisition, and to identify what modalities would be desirable for this type of publishing and/or use, information and data were recorded and examined in three main areas:

> the researchers' current methods of publishing and accessing scientific information;

> the researchers' views on the opportunities for publication and use offered by open access;

> the researchers' expectations in terms of the content modalities as well as the technical and organisational framework conditions surrounding the publication and use of material in open access.

1. *According to a study of the British SHERPA project, the vast majority of publishing houses (including international ones) allow the secondary publication of works that have already appeared in published journals, although the conditions imposed on the secondary publication vary from case to case. A list of these conditions can be obtained from http://www.sherpa.ac.uk/romeo.php.*

2. *A detailed overview of the development of the open access movement is given by Peter Suber in: Timeline of the Open Access Movement. http://www.earham.edu/~peters/fos/timeline.htm. Open access is not just a form of publication, but has itself become the subject of an intense scientific debate about the publishing industry. In April 2005, the first extensive bibliography of subjects on this topic was issued and is also available online free of charge. Charles W. Bailey, Jr.: Open Access Bibliography. Liberating Scholarly Literature with E-Prints and Open Access Journals. Association of Research Libraries 2005. http://info.lib.uh.edu/cwb/oab.pdf.*

The data collected were analysed according to biographical and profession-specific variables. In this regard, current publishing practices and the readiness to exploit electronic publishing opportunities had to be identified above all within the context of the research discipline from which the respondents came.

This report presents the results of the survey. The first part (section 2) presents the empirical bases, methodology and process. The remaining structure of the study largely follows the four content-based sections of the questionnaire, which cover respondents' publishing habits and means of accessing scientific information (section 3), the actual importance and subjective assessment of open access (section 4), cost aspects of scientific publishing (section 5), and publication funding by the DFG (section 6). Finally, section 7 examines the proposals and recommendations made by the respondents on how the DFG could promote open access more strongly. Respondents' answers have been documented in an extensive series of tables [1], and have been broken down for analysis by scientific discipline, research area, status, professional position, age and sex. The last part of the table series classifies the analyses according to the characteristics of the sampling structure (section 2).

Further analyses in an extensive series of tables

1. *Deutsche Forschungsgemeinschaft (2005). Publikationsstrategien im Wandel? Tabellenband. http://www.dfg.de/zahlen_und_fakten/*

2 Study concept and process

The empirical basis for this publication is a survey of scientists and academics who were funded by the DFG in different programmes between 2002 and 2004.

In general all researchers who have completed their academic education (usually a doctorate) are eligible to apply to the DFG for funding; for researchers working in non-university institutions there was however one restriction during the period being considered, in that they could only apply for funding in an area outside the main scope of the work of their institution or working group [1]. In addition to funding individual projects, the DFG also funds research projects within the framework of coordinated programmes, which aim to promote cooperation between scientists and build capacities [2]. In view of the wide circle of applicants, it can be assumed that the results of a survey of DFG-funded scientists and academics will produce a generally representative picture of German top-level research. The study should above all take into account the different publishing habits and ways of accessing information in the individual research cultures and their potentially differing views on open access. The survey therefore included members of all scientific disciplines and also differentiated between young and established researchers. For this reason individuals being funded in programmes for young researchers (e. g. the Emmy Noether Programme, the Heisenberg Programme, and a programme for "Temporary Positions for Principal Investigators") were also included in the survey.

2.1 Sampling procedure

Sample: 1600 DFG-funded scientists and academics from all scientific disciplines

The survey was addressed to 1,600 scientists and academics who had been or were being funded in different DFG programmes. They were selected according to a stratified sample structure, which offers the advantage over purely random sampling that it allows the inclusion of smaller sampling units. This method was designed to ensure that the study delivered a sufficiently reliable body of data, even in disciplines with a relatively small number of funded researchers, which would also ensure an adequate representation of young researchers.

The quota criteria applied were the status of the person being funded at the time of proposal submission (established researchers versus young researchers), and the four broad scientific disciplines (humanities and social sciences, life sciences, natural sciences and engineering sciences).

The four scientific disciplines constitute the top hierarchical level in the DFG's subject classification system (cf. Table 2.01). This system includes the division of 201 individual subject areas into a total of 45 review boards, whose members are elected by the scientific community. For statistical purposes, the review boards are classified into 14 research areas, which are allocated to the four scientific disciplines. Table 2.01 shows the connections between the review boards, research areas and scientific disciplines.

1. *Since January 2005 there has been a new rule governing the eligibility of scientists from non-university research institutions within the framework of individual funding; see at http://www.dfg.de/aktuelles_presse/information_fuer_die_wissenschaft/andere_verfahren/info_wissenschaft_03_05.html.*
2. *A detailed description of the funding programmes and details on how to apply can be found on the DFG website at www.dfg.de; see also Deutsche Forschungsgemeinschaft: Annual report 2004. Aufgaben und Ergebnisse at http://www.dfg.de/jahresbericht. See also Table 2.02.*

Table 2.01:
DFG classification system for Review Boards, research areas and scientific disciplines
(As of 2005)

	Review Board	Research Area	Scientific Discipline
101	Ancient Cultures	Humanities	Humanities and Social Sciences
102	History		
103	Fine Arts Studies		
104	Linguistics		
105	Literature, Theatre and Media Studies		
106	Ethnology, Non-European Cultures, Religious Studies		
107	Theology		
108	Philosophy		
109	Education Sciences	Social and Behavioural Sciences	
110	Psychology		
111	Social Sciences		
112	Economics		
113	Jurisprudence		
201	Foundations of Biology and Medicine	Biology	Life Sciences
202	Plant Science		
203	Zoology		
204	Microbiology, Virology and Immunology	Medicine	
205	Medicine		
206	Neurosciences		
207	Agriculture, Forestry, Horticulture and Veterinary Medicine	Agriculture, Forestry, Horticulture and Veterinary Medicine	
301	Molecular Chemistry	Chemistry	Natural Science
302	Chemical Solid State Research		
303	Physical Chemistry of Molecules, Liquids and Interfaces, General Theoretical Chemistry		
304	Analytical Chemistry, Method Development		
305	Chemistry of Biological Systems		
306	Polymer Research		
307	Condensed Matter Physics	Physics	
308	Optics, Quantum Optics and Physics of Atoms, Molecules and Plasmas		
309	Particles, Nuclei and Fields		
310	Statistical Physics and Nonlinear Dynamics		
311	Astrophysics and Astronomy		
312	Mathematics	Mathematics	
313	Atmospheric Science and Oceanography	Geosciences (incl. geography)	
314	Geology and Palaeontology		
315	Geophysics and Geodesy		
316	Geochemistry, Mineralogy and Crystallography		
317	Geography		
318	Water Research		
401	Production Technology	Mechanical Engineering and Production Technology	Engineering Science
402	Mechanics and Constructive Mechanical Engineering		
403	Process Engineering, Technical Chemistry	Heat Energy Technology/ Process Engineering	
404	Heat Energy Technology, Thermal Machines and Drives		
405	Materials Engineering	Materials Science	
406	Materials Science, Raw Materials		
407	System Engineering	Electrical Engineering, Computer Science and System Engineering	
408	Electrical Engineering		
409	Computer Science		
410	Construction Engineering and Architecture	Construction Engineering and Architecture	

Each scientific discipline had to be represented by the same number of people surveyed in the sample. The percentage ratio between the two status groups (established researchers and young researchers) was set at 80:20 [1]. Within these circumscribed sub-groups, the persons surveyed were selected at random and are thus representative in a statistical sense.

The "scientific discipline" and "professional status" sampling characteristics represent the main areas for analysis of this report. Many of the findings are also presented according to individual research area. Where significant differences could be observed within the scientific disciplines and research areas, the answers were also analysed in relation to review boards.

2.2 Questionnaire

The questionnaire was designed above all to establish the status and acceptability of open access as a new form of scientific publishing. In order to place these assessments in their correct context, the introductory questions related to the general publishing habits and means of accessing information in the different disciplines.

Questions about publishing habits and means of accessing information; experience with open access and the use of the publication grant

The questionnaire was drawn up by a working group from the DFG's head office, in cooperation with external experts experienced in publishing open access journals. The initial step was to review the draft questionnaire as to contents, form and empirical methodology. In a final pre-test the revised questionnaire was checked for completeness of content and conclusiveness, for comprehension problems and validity; minor revisions were made. The questionnaire, which is included in the appendix, was composed of five sets of questions totalling 38 questions in all. The first three sections covered the publishing habits of the researchers surveyed and their means of acquiring information, their experiences and views on open access publications, and economic aspects in relation to publishing in conventional or open access journals. Respondents were also asked to state how they had previously used the DFG's publication grant. The final part of the questionnaire was reserved for recording the demographic details that are essential to any detailed analysis of responses.

In addition to closed, multiple-choice questions, the questionnaire also provided space for respondents to write open answers. This allowed respondents who had not yet published in open access to state the reasons in their own words. The same open format was used when asking about ways in which the DFG could promote open access publications. Finally, researchers were asked to provide any additional comments, recommendations or suggestions on the DFG's publication funding policy and/or a policy for promoting open access.

1. *See also Table 2.02.*

2.3 Field phase, response and representativeness

To carry out the study, both a printed and an online version of the questionnaire were developed. All persons surveyed received a printed copy of the questionnaire, which also contained personal information on how to access the online version. The printed questionnaires were sent out at the beginning of October 2004, at which time the online questionnaire was also activated. The field phase ended on 24 November 2004, by which time two reminders had been sent.

By the end of the survey, a total of 1,083 questionnaires had been returned either by post or online, resulting in a response rate of 67.7 %. The questionnaires were first checked for completeness, and then the procedure for correcting and checking the data was established and carried out. At the end of this first examination, approximately 10 % of the questionnaires completed online (about 3.4 % of all completed questionnaires) had to be excluded from the subsequent evaluation. None of the questionnaires returned by post had to be excluded. From the 1,083 questionnaires that were returned, 1,028 were deemed useable. Of these, 505 had been received online and 523 by post. Measured against the number of questionnaires sent out, the take-up rate was 64.3 %. This is significantly higher than the response rate for similar studies and shows the high level of interest accorded to the topic by DFG-funded researchers.

Over two-thirds of those asked took part in the survey

Table 2.02 shows the relationship between the scientific discipline and professional status, first in relation to the sample selection, and second in relation to the response.

Overall, the distribution by scientific discipline and status group of those who completed the questionnaire matches the sample. Differences between the gross and net sample are evident above all in the humanities and social sciences. In this discipline there was a generally lower level of participation, which worked significantly to the disadvantage of established researchers. However, the differences in participation levels between the different groups in the survey are too minor as to call into question the representativeness in relation to the gross sample.

Table 2.02:
Response Statistics

Scientific Discipline*	Status**	Gross Sample			Participant Distribution		
		n	% per Scientific discipline.	% Total	n	% per Scientific discipline.	% Total
Humanities and Social Sciences	Early-stage Researchers	80	20.0	5.0	60	25.9	5.8
	Established Researchers	320	80.0	20.0	172	74.1	16.8
Life Sciences	Early-stage Researchers	80	20.0	5.0	46	17.5	4.5
	Established Researchers	320	80.0	20.0	217	82.5	21.2
Natural Science	Early-stage Researchers	80	20.0	5.0	59	22.1	5.8
	Established Researchers	320	80.0	20.0	208	77.9	20.3
Engineering Sciences	Early-stage Researchers	80	20.0	5.0	53	20.1	5.2
	Established Researchers	320	80.0	20.0	211	79.9	20.6
Total		**1600**		**100.0**	**1026**		**100.0**

* Allocated by the Review Board in which the last project proposal was assessed.

** Professional status at time of last funding application.

Before being analysed the questionnaires sent in by post were scanned and merged with the data submitted online in an SPSS system file.

2.4 Sample description

In line with the response rates given above, the study included data from a total of 1,028 scientists and academics. The respondents were asked to categorise their main area of research according to the DFG classification system (cf. Table 2.01). Approximately 25 % of the respondents were assigned to the humanities and social sciences and the life sciences, 22 % to the engineering sciences, and 30 % to the natural sciences. Table 2.03 illustrates the distribution of respondents by scientific discipline and research area.

The proportion of female scientists in the respondents group was 16 %. This divided into 24 % in the humanities and social sciences and life sciences, 9 % in the natural sciences, and 8 % in the engineering sciences.

Table 2.03:
Distribution of Respondents by Scientific Discipline and Research Area
(in percent and absolute figures)

Scientific Discipline	Research Area	Percent*	n
Humanities and Social Sciences	Humanities	52.1	124
	Social and Behavioural Sciences	44.1	105
	Research area not specified	3.8	9
	All	**100.0**	**238**
Life Sciences	Biology	45.1	115
	Medicine	45.5	116
	Agriculture, Forestry, Horticulture and Veterinary Medicine	5.5	14
	Research area not specified	3.9	10
	All	**100.0**	**255**
Natural Science	Chemistry	34.1	105
	Physics	32.5	100
	Mathematics	10.7	33
	geosciences / earth sciences	19.8	61
	Research area not specified	2.9	9
	All	**100.0**	**308**
Engineering Sciences	Mechanical Engineering and Production Technology	12.3	28
	Heat Energy Technology/ Process Engineering	13.7	31
	Materials Science	18.1	41
	Electrical Engineering, Computer Science and System Engineering	43.6	99
	Construction Engineering and Architecture	6.6	15
	Research area not specified	5.7	13
	All	**100.0**	**227**
Total			**1028**

* Basis for percentage calculation: Scientific discipline

Basis: 1,028; No response: 0

Question 33: Please name the subject area that includes the focus of your research. Please enter the subject code which you will find on the back of the questionnaire.

More than half of all respondents are professors, and a further 15 % are university lecturers or "privatdocents". The remaining third comprises university assistants, research assistants, research fellows and scientists who work in another position at a university or non-university research institution.

In a comparison of scientific disciplines (cf. Table 2.04), the following picture emerges:

> The vast majority of professors are in the humanities and social sciences (62 %), the smallest number in the life sciences (43 %).

> Around a quarter of the life scientists work as university lecturers or privatdocents, compared to 13 % in the natural sciences, and 10 % in the other disciplines.

> The percentage of university assistants varies relatively little between the disciplines, ranging from 6 % in the life sciences to nearly 8 % in the natural sciences.

> A high proportion of research assistants are to be found in the life and natural sciences, at about 16 % each. This percentage was lowest in the humanities and social sciences, at almost 9 %.

> Most research fellows come from the humanities and social sciences (8 %), and the fewest from the engineering sciences (3%).

In order to be able to consider the categories of "young researcher" and "established researcher" in the further analysis, the limitation of employment contracts was used as an important differentiating criterion. Research assistants at universities or non-university research institutions were therefore classified as young researchers if they had limited contracts; permanent staff or those with civil servant status (on a permanent contract basis) were classified as established researchers (cf. Table 2.05).

Table 2.04:
Professional Status (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Professor	61.6	42.6	47.7	59.9	**52.3**
University Lecturer/ Privatdozent	10.8	24.5	12.8	9.9	**14.6**
University Assistant	7.3	6.0	7.6	7.2	**7.1**
Research Assistant	8.6	16.1	16.1	12.6	**13.6**
Research Fellow	7.8	5.6	6.6	2.7	**5.8**
Other	3.9	5.2	9.2	7.7	**6.7**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	232	249	304	222	**1.007**

Basis: 1,028; No response: 21
Question 34: Professional status

The majority of respondents (85 %) were employed at a university at the time of the survey, while only 15 % worked at a non-university research institution. These were distributed quite evenly – at about 3 % – throughout the large, well-known German research institutions (cf. Table 2.06). Only the proportion of respondents working at a Fraunhofer institute is lower, at nearly 1 % (cf. Table 2.07).

Table 2.05:
Established Researchers and young Researchers (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Established researchers	84.4	81.9	84.9	90.3	**85.2**
Early-stage researchers	15.6	18.1	15.1	9.7	**14.8**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	231	248	298	217	**994**

Basis: 1,028; No response: 34
Question 34: Professional status: Question 36: How long is your current employment contract?

Table 2.06:
Institution of Employment at Time of Survey (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
University	93.9	81.0	79.4	86.1	**84.6**
Max Planck Society	0.9	4.0	4.3	2.3	**3.0**
Fraunhofer Society		0.4	1.3	1.4	**0.8**
Helmholtz Association	0.4	5.3	2.3	5.1	**3.2**
Leibniz Association	1.3	4.0	6.3	0.9	**3.4**
Other institution	3.5	5.3	6.3	4.2	**4.9**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	230	247	301	216	**994**

Basis: 1,028; No response: 34
Question 35: Where do you work?

Table 2.07:
Age Group (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
30 or under	1.3	2.4	3.9	2.2	**2.5**
31 to 40	26.5	32.9	39.9	29.5	**32.8**
41 to 50	27.7	42.4	27.6	31.7	**32.2**
51 to 60	24.8	16.9	16.9	21.6	**19.7**
61 or older	19.7	5.5	11.7	15.0	**12.7**
Total	100.0	100.0	100.0	100.0	**100.0**
Count (n)	**238**	**255**	**308**	**227**	**1.028**

Basis: 1,028; No response: 0
Question 37: Which age group do you belong to?

An analysis by scientific discipline reveals that

> the number of respondents working at a university is highest in the humanities and social sciences.

> one-fifth of the natural scientists work outside the universities, most of whom at Leibniz institutes.

> most of the life and engineering scientists employed outside universities work for the Helmholtz Association.

Other non-university research institutions mentioned included research institutes abroad, federal research institutes, etc.

The age of respondents was established using predefined groups. Almost a third of all respondents were in the 31 to 40 or 41 to 50 age groups. Three-quarters of the life scientists fall into the middle age groups, between 31 and 50 (cf. Table 2.07).

3 Information acquisition and publishing habits

3.1 Use of different publication media

Scientific progress relies on the rapid exchange of the latest research results. Being able to access the latest scientific knowledge in the individual disciplines quickly is just as important as informing each specialist community about research studies and results quickly.

Here the ways in which the different disciplines both access and publish information vary considerably. Apart from the separate scientific traditions, the international orientation of the individual disciplines also makes a difference; also, differences in regional importance as well as career-specific aspects have to be taken into account depending on subject and speciality. Finally, the preference of different publication media depends on the application and the pace of knowledge discovery in different scientific disciplines.

With regard to how the respondents gained access to information (cf. Table 3.01), use of the different publishing media varied across the scientific disciplines and research areas: A relatively wide use of different forms of publication in the humanities and social sciences contrasts with a clear preference for certain types of publication in the other scientific disciplines.

While the overwhelming majority of respondents in all disciplines access new information either frequently or very frequently through articles in scientific journals, other types of publication were used by less than half of the respondents. These publication forms include, in the order preferred, articles in edited volumes, papers in conference proceedings and monographs.

Table 3.01:
Publication media frequently used for accessing current information in research area (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Articles in journals	93.6	98.0	95.8	90.7	**94.7**
Contributions in edited volumes	74.8	39.6	41.0	40.2	**48.4**
Monographs	70.9	20.5	33.1	36.1	**39.6**
Contributions in proceedings	44.6	26.0	31.9	83.9	**44.9**
Reviews	38.2	7.5	3.8	6.2	**13.3**
Grey literature	14.9	3.7	9.9	9.7	**9.4**
	100.0	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	236	255	307	225	**1.023**

Basis: 1,028; No response: 5
Question 1: To get the latest information in your research area, how often do you use the following types of publication? (Answer category 1= 'very often' to 5 = 'very rarely' ; Categories 1 and 2 combined).

Although there is a clear difference in the frequency of use of specific forms of publication between the different scientific disciplines – for example 33% of the natural scientists surveyed use monographs frequently or very frequently, compared to almost 21% of the life scientists – there is a similar trend. However, there are two exceptions:

Articles in scientific journals are the most important source of information, but...

> Although less than half of the natural and life scientists frequently use publications other than articles in journals, around 84% of those surveyed in the engineering sciences access new information from papers in conference proceedings. The use of these publications thus took second place in this scientific discipline. If the findings are analysed more closely, it is clear that the use of proceedings in all engineering research areas is rather high: Around 96% of mechanical engineers and production engineers and 93% of architects and civil engineers use conference proceedings frequently or very frequently. Engineers in the areas of heat energy technology and process engineering indicated the lowest usage of articles in proceedings, at 73%.

...so are proceedings in the engineering sciences...

> Another exception in accessing information is revealed in the humanities and social sciences. While for respondents in other scientific disciplines journals are by far the most frequently used source of information, researchers in the humanities and social sciences also use other media to a much greater extent. Articles in edited volumes are an important source for around three-quarters of the humanities scholars and social scientists, but for only 40% of other researchers. Monographs are used frequently or very frequently by 71% of the humanities scholars and social scientists, but by only 30% of other researchers. There are clear differences, too, in the use of reviews: Around 38% of respondents in the humanities and social sciences often get information from reviews, while the proportion in the other disciplines is just 6%. When it comes to grey literature, the percentage ratio between the humanities and social sciences and others is 15:8.

...as well as other media in the humanities and social sciences

Closer analysis reveals that the way in which humanities scholars access information is clearly different from that of their colleagues in the social sciences. Although both groups indicate journal articles as a frequent source of information (at 93% each), contributions to edited volumes are used frequently or very frequently by approximately 88% of researchers in the humanities, but by only 58% of those in the social and behavioural sciences. A similar picture emerges for monographs, which are used relatively frequently by 85% of humanities scholars but by only 53% of social and behavioural scientists. With regard to contributions in proceedings, the percentage ratio between representatives of the two research areas is 60:24, 55:15 for reviews, and 6:22 in the use of grey literature.

When questioning the ways that respondents access information, it is clear that respondents were also asked about the preferred form of publication for their own research. As expected most articles are published in scientific journals. In the last five years, the scientists surveyed have published an average of 20 articles each in periodicals (cf. Table 3.02).

An average of 20 articles in the last five years...

The largest number of journal articles were published by the life scientists, and the fewest by the humanities scholars and social scientists. Engineering scientists, on the other hand, published far more papers in proceedings than researchers in other fields. Humanities scholars and social scientists preferred to publish their shorter scientific studies in edited volumes, compared to scientists in other disciplines. The same applies to monographs: With more than two book

publications in the last five years, they do not publish in book format significantly more than life scientists, but far more than respondents in other scientific disciplines. However, this analysis must take into account the sometimes considerable standard deviations [1].

... with large differences within fields

If the responses regarding specialist journals are analysed more closely, significant differences between the representatives of different research areas within the individual scientific disciplines sometimes appear. On average, social scientists have published approximately 16 articles in the last five years, while humanities scholars have published close to 10. The highest publication rates in specialist journals can be found in the area of law/jurisprudence, at around 24 articles, the lowest in philosophy, with 6.

While in the life sciences publication rates are relatively uniform across the individual research areas and fields, in the natural sciences it is above all physicists (27) and chemists (25) who reveal above-average rates, with geoscientists (14) and mathematicians (13) averaging much lower. In the engineering sciences, too, the number of journal publications varies considerably: In the materials sciences an average of 25 articles were published in the last five years, compared to 11 articles in the fields of electrical engineering, computer science and system engineering. That discipline-specific habits play an important role is shown by looking at the number of contributions in conference proceedings, where the values are an exact mirror-image: Here researchers in the fields of electrical engineering, system engineering and computer science have the most contributions, with about 26 articles, followed by mechanical engineers and production engineers (20) and material scientists (15). In other disciplines this type of publication is obviously less important.

Humanities scholars and social scientists prefer to publish their research studies in edited volumes and monographs. The highest number of articles published in

Table 3.02:
Number of articles published conventionally through scientific publishers
(Average value and standard deviation)

		Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**All**
Journal articles	a	12.7	23.6	21.8	17.6	**19.2**
	s	13.9	24.1	17.5	21.0	**19.8**
Papers in proceedings	a	4.0	5.7	5.9	20.4	**8.7**
	s	6.1	13.7	9.4	28.4	**17.4**
Contributions in edited volumes	a	6.2	1.3	0.9	2.2	**2.5**
	s	8.0	2.6	1.7	4.5	**5.0**
Monographs	a	1.4	0.5	0.2	0.5	**0.6**
	s	2.8	1.5	0.7	1.2	**1.7**
Other	a	1.0	0.4	0.2	0.1	**0.4**
	s	10.0	3.6	1.7	0.8	**5.2**
Number (n)		**199**	**213**	**266**	**197**	**875**

Basis: 1,028; No response: 153
Question 16: In the last five years: How many of your studies have you published in a conventional form within this period? (i.e. via publishers in printed or digital form and offered to readers against payment)

1. *Standard deviation: The higher the measurements are scattered around the mean value, the higher the measured value – this shows that even within the individual scientific disciplines the frequency of use of different publishing channels varies widely amongst respondents.*

edited volumes can be found amongst all humanities and social sciences subjects that occupy the first twenty places of all 48 single disciplines; the same applies for monographs.

Other studies into the publishing behaviour of research scientists show similar patterns in the different types of publication in each scientific discipline (cf. Enders/Mugabushaka 2004, in particular Chapter 6).

Regardless of scientific discipline, research area, individual discipline or form of publication, young researchers presented fewer publications than established researchers [1], although it must be noted that in some cases their research publishing activity goes back less than five years. While established researchers in the humanities and social sciences, for example, published around 14 journal articles in the last five years, the number for young researchers was only 6. In the life sciences the ratio between established and young researchers was 27:9, in the natural sciences 24:11, and in the engineering sciences 19:7.

3.2 Publishing in scientific journals: criteria for selecting suitable periodicals

The data provided by respondents were also used to determine the criteria applied by authors when selecting a journal in which to publish their own research results. The respondents were asked to rate a total of ten items on a scale from 1 to 5. They were asked, for example, about the importance of a journal's reputation, the importance of peer reviews and the role of publication costs.

Before the significance of the different aspects was analysed in percentage terms, the items underwent a factor analysis. After that the individual criteria were divided into four categories and used for comparison (cf. Table 3.03).

Specialist orientation:

The specialist focus or thematic relevance of a journal had its own unique status in comparison to other aspects. Almost 93 % of the authors regarded this criterion as important or very important when deciding on a journal in which to publish their studies.

International specialist importance:

This heading can be used to cover individual aspects relating to the international distribution of the selected journal, its reputation among specialists and its impact factor.

Organisational qualities:

This heading encompasses questions relating to the review quality of the articles submitted, the interval between submitting an article and its publication, and the long-term availability of the journal.

Cost aspects:

This heading covers aspects relating to publishing costs that must be borne by the author, subscription prices, payments to authors and the amount of their fees. However, the overall category labelled "cost aspects" was only regarded as important or very important by 3 % of all respondents.

1. *For the category of young researchers, see the lists in Table 2.04.*

If certain aspects are examined separately, the specialist focus of the journal emerges on top. For over 90% of the respondents in each of the different scientific disciplines, this is the most important criterion when choosing a place of publication. For engineering scientists in particular, followed by natural scientists, this criterion is even more important than for humanities scholars and social scientists or life scientists.

Internationality in life and natural sciences

For respondents in the life and natural sciences, the individual aspects combined under the heading "International specialist relevance", including the level of international distribution of the journal in which they wish to publish, are even more important than its thematic orientation. In the life sciences, only the horticultural, agricultural and forestry scientists and veterinarians gave slightly less emphasis to the high or extremely high weighting of this single criterion, at 85 %, than their colleagues in the other single disciplines grouped under this heading, nearly 100% of whom agreed. In the natural sciences it is the mathematicians (88%) and geoscientists (95%) who mention the international orientation of the journals selected for publication slightly less frequently.

Table 3.03:
Main aspects when selecting a journal for publishing scientific work
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Specialist orientation					
Specialist focus / subject relevance of journal	90.0	90.7	93.3	97.7	**92.6**
International specialist importance					
Journal's international distribution	80.7	98.0	97.3	90.5	**92.2**
Journal's reputation	85.1	93.4	93.7	89.5	**90.7**
Journal's impact factor/ frequency of citation	42.7	83.3	66.1	50.2	**61.7**
Organisational qualities					
Quality of reviewing of work submitted	74.1	84.1	86.6	84.5	**82.7**
Speed of publication	52.8	65.3	61.0	57.7	**59.5**
Journal's long-term availability	63.8	52.9	65.4	59.8	**60.7**
Cost aspects					
Publication costs to author	20.7	16.8	27.3	27.2	**23.2**
Journal's subscription price	3.6	5.0	14.6	10.6	**8.8**
Fees paid to author	2.2	0.4	0.7		**0.8**
Count (n)	230	246	301	220	**997**

Basis: 1,028; No response: 31
Question 6: When you wish to publish a study in a scientific journal: How important are the following aspects? (answer category 1 = 'very important' to 5 = 'not at all important'; categories 1 and 2 combined).

A journal's international distribution also plays an important role among the humanities scholars and social scientists, at around 81 %, although to a somewhat lesser degree than in other disciplines. It is above all the social and behavioural scientists who accord this criterion a relatively low significance: Only 72 % give a journal's international distribution as one of their main selection criteria for publication, in contrast to 87 % of the humanities scholars. In terms of individual research area, only 64 % of those in the social sciences and law regarded this aspect as important or very important. More importance was naturally attributed to this aspect by ethnologists, academics in the field of religious studies and non-European cultures (100 %), ancient cultures (100 %), and also by psychologists (97 %) and historians (91 %).

Reputation

The journal's reputation is the third most important criterion considered when selecting a suitable journal in which to publish. Humanities scholars and social scientists perceived this aspect as less important, compared to researchers from other disciplines. Whereas 90 % of the social and behavioural scientists stated that this factor was important or very important, only 80 % of the humanities scholars were of the same opinion.

Impact factor

The impact factor plays a different role within the individual disciplines. It is regarded as an important or very important criterion when selecting a suitable type of publication by 55 % of the social and behavioural scientists, but by only 31 % of the humanities scholars. In the life sciences it plays an important role for only 54 % of agricultural and forestry scientists, horticulturalists and veterinarians, compared to about 84 % for the representatives of other disciplines grouped under this heading. In the natural sciences, it is above all the mathematicians who accord this criterion relatively low importance, at 31 %.

Most important to young researchers

In comparison to established researchers, the impact factor clearly and understandably plays a more important role for young researchers, in particular in the humanities and social sciences and engineering sciences. While in the engineering sciences 70 % of young researchers consider this criterion as important when selecting a suitable journal for publication, this applies to only 50 % of the established researchers. In the humanities and social sciences, the percentage ratio between young and established researchers is 55:31.

Of the aspects classified under "organisational qualities", the quality of the peer review of articles submitted was somewhat less important to the humanities scholars and social scientists than to representatives of other disciplines, more than 80 % of whom viewed this as being important or very important [1]. Only 73 % of the respondents in the humanities and 74 % of the social and behavioural scientists shared this opinion.

1. *With one single exception in the agricultural and forestry sciences, horticulture and veterinary medicine. Here 77 % of the respondents viewed this criterion as important.*

3.3 Target audience for own publications

The target group is primarily one's own scientific community...

The work produced by the researchers and academics in the study is naturally aimed first and foremost at their own scientific peers. Asked about the readership to which their own publications were mainly addressed, almost 99 % of the respondents named the colleagues in their own area. The differences between the scientific disciplines are negligible (cf. Table 3.04).

... which is viewed increasingly as international

Researchers in neighbouring disciplines were mentioned as likely or interested readers, ranking second. The gap between these two target groups is considerable, amounting to approximately 57 % in the engineering sciences and 43 % in the life sciences. The application-oriented target audience, which ranks third, has figures that are markedly below those of the first two groups. As might be expected, it is mainly authors in the engineering sciences who include this group amongst their target readership. If a comparison is made between the individual research areas, it is mainly architects and civil engineers who mention practitioners (73 %), followed at some distance by the mechanical engineers (48 %). In the engineering sciences, clear differences are revealed between the established researchers (39 %) and young researchers (29 %).

When it comes to targeting application-oriented users, the place of employment plays a decisive role. While approximately 17 % of those employed at universities and 20 % of researchers working at non-university research institutions mainly or predominantly address their work to this type of readership, the percentage varies considerably between the non-university research institutes, a phenomenon which is adequately explained by the emphasis on the content of the research by the respective institutes: Approximately 88 % of the researchers at Fraunhofer institutes, and 28 % of those employed by the Helmholtz Association overwhelmingly or predominantly emphasise an application-oriented readership.

Table 3.04:
Main readership for own publications (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	Total
Scientists in my own discipline	98.7	99.6	98.7	98.7	**98.9**
Scientists in neighbouring disciplines	55.4	54.4	42.2	41.3	**48.2**
Application-oriented target groups	14.4	6.7	14.2	38.8	**18.1**
Interested lay readers	15.8	2.5	2.5	1.0	**5.2**
Other	10.0		4.8	11.1	**6.2**
Count (n)	235	255	308	225	**1.023**

Basis: 1,028; No response: 5
Question 2: What readership are your own publications usually intended for?
(Answer category 1= 'overwhelmingly' to 5 = 'not at all' ; Categories 1 and 2 combined).

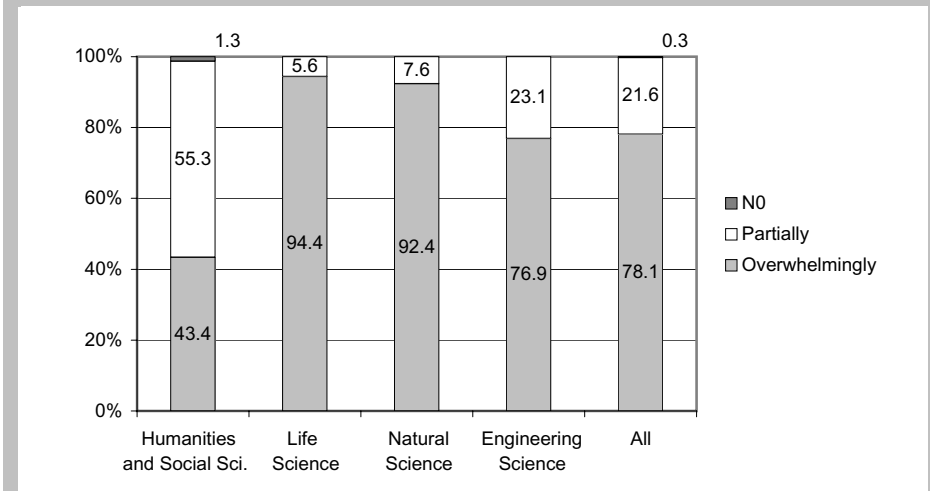
With the increasing internationality of research, it is hardly surprising that the respondents' publications are addressed primarily to a global scientific community (cf. section 3.2 on the international orientation of publications). Around 78 % of the respondents stated that they addressed their publications overwhelmingly to researchers outside Germany (cf. Figure 3-1).

In the life and natural sciences, more than 90 % of the respondents address their work to an international readership. Two findings need closer examination.

> In comparison to other scientific disciplines, the international relevance is emphasised much less strongly by humanities scholars and social scientists. The international relevance is only partially relevant for 55 % of these respondents, compared to just 6 % of the life scientists, 8 % of the natural scientists, and 23 % of the engineers. After all 50 % of the social and behavioural scientists address their work mainly to an international audience, compared to only 38 % in the humanities. The wide differentiation between individual subjects shows that it is above all representatives of education science (88 %), literature, theatre and media studies (84 %) and historians (79 %) who only partially target an international audience. By contrast, 82 % of the psychologists, 71 % of the ethnologists and academics working in the field of religious studies and non-European cultures, as well as 50 % of the philosophers, claimed to write overwhelmingly for an international readership.

> A total of 22 % of the engineering scientists indicated that they address their publications only to a limited extent to a non-German peer audience. This more national orientation, in comparison to the life and natural sciences, is observed in the fields of architecture, civil and mechanical engineering (54 %) and production engineering (52 %).

Figure 3-1:
Researchers outside Germany as target group for own publications
(in percent)



Basis: 1.028; No response: 19
Question 3: Do you address your publications also to researchers outside Germany?

3.4 Languages used when accessing and publishing scientific information

Four out of five texts read are written in English...

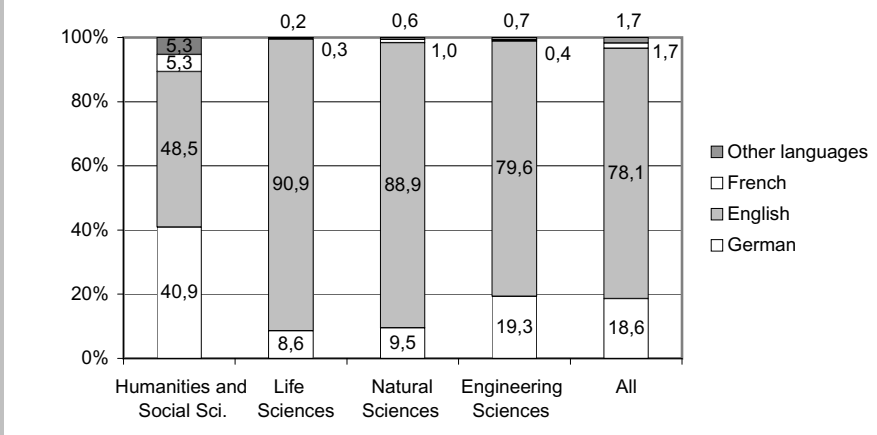
In most disciplines English has evidently been adopted as the language of publication. Over 78 % of all publications read by the scientists and academics surveyed were English-language publications (cf. Figure 3-2).

If the humanities and social sciences, in which language itself is the subject of research, are excluded, the percentage of scientific texts read in English rises to an average of approximately 87 %. Almost half of the specialist publications accessed in the humanities and social sciences are written in English, but 41 % of all publications are still published in German. In the other scientific disciplines, between 80 % and 91 % of the specialist publications are read in English, with other languages playing a more marginal role. In the engineering sciences 19 % of the publications read by respondents were still written in German, compared to 9.5 % in the natural sciences and just over 8.5 % in the life sciences.

... and in the life sciences and natural sciences, three out of four are published in English

An analysis of the subjects grouped under the humanities and social sciences shows once again the differences imposed by subject-specific habits and the fact that language itself is the object of research. In the humanities in the narrower sense around 45 % of the texts read are in German, compared to 37 % in the social and behavioural sciences. Educationalists access around 83 % of their specialist literature in German, compared to 63 % of the academics in the fields of literature, theatre and media studies, and 58 % of the theologians. Linguists (27 %), psychologists (17 %), ethnologists and academics in the field of non-European cultures and religious studies (16 %) are much less likely to access German-language publications.

Figure 3-2:
Percentage of different languages used in accessing scientific texts
(average value of percentage values)



Basis: 1,028; No response: 86

Question 4: When you read scientific texts or publish scientific studies yourself: What role is played by the following languages? Please give an estimate in percent.

Complementary to ways of accessing information, similar linguistic tendencies can also be found in publishing practices: Around three-quarters of the academics and researchers surveyed publish their own work in English. Less than a quarter of the material is published in German, which is largely due to publishing intentions to target an international readership (cf. Table 3.05). Once again the humanities scholars and social scientists form the exception to this trend, in whose publications the German language still plays an important role.

Table 3.05:
Percentage of different languages used in publishing own scientific work
(arithmetic mean of percentage values)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
German	59.7	10.6	7.9	21.9	**23.5**
English	36.1	89.1	91.9	78.0	**75.4**
French	1.7	0.1	0.1	0.1	**0.4**
Spanish	0.7	0.1	0.1		**0.2**
Other languages	1.9	0.1	0.1	0.1	**0.5**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	215	230	289	208	**942**

Basis: 1,028; No response: 86
Question 4: When you read scientific texts or publish scientific studies yourself: What role is played by the following languages? Please give an estimate in percent. - I publish around 'x' percent of my own work in the following languages.

Approximately 60 % of the publications in the humanities and social sciences appear in German. A closer analysis again reveals significant differences between individual subjects. Economists publish 74 % of their work in English, psychologists 73 % and ethnologists, and academics in the area of religious studies and non-European cultures 61 %. By contrast, 91 % of educationalists' publications are published in German. It should be noted here that the use of German also correlates with the intended target audience of the individual disciplines (cf. above under 3.3).

3.5 Involvement in the publication of scientific journals

Approximately 43 % of the respondents indicated that they actively participate in the publication of scientific journals. Humanities scholars and social scientists are most frequently involved in journal publication, followed by the life scientists (cf. Table 3.06). Taking into account the multiple attributions – different respondents are active in various functions for different journals – it emerges that participation in the scientific advisory committees of journals is more frequent than the function of (co-)editor.

For obvious reasons, young researchers are less likely to participate in the editing of scientific journals. In the humanities and social sciences, 59 % of the established researchers, compared to just 19 % of the young researchers, are engaged in the publication of journals. In the life sciences the percentage ratio between established and young researchers engaged in this activity is 51:13, in the natural sciences 43:20, and in the engineering sciences 53:24.

Table 3.06:
Involvement in the publication of scientific journals
(in percent, multiple references allowed)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
No involvement	50.7	58.9	63.7	53.7	**57.3**
(Co)editor of one or more journals	25.1	11.2	15.9	18.7	**17.5**
Scientific committee of one or more journals	33.2	24.1	16.6	23.4	**23.8**
Other function	8.5	12.0	11.4	13.6	**11.4**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	223	241	289	214	**967**

Basis: 1,028; No response: 61
Question 9: Are you involved in the publication of scientific journals?

The following section deals with status of scientific journals published by German publishing houses. It remains to be seen whether proposals to strengthen the international reputation of German scientific periodicals vary against the background of existing publishing expertise.

3.6 The internationality of German publishing houses: an assessment

Against the background of the increasing internationalisation of science and the evident increase in the universal use of English in many fields, stands the question of the importance of German publishing houses. There are three main questions of interest:

1. *Which are the most important scientific journals in the individual research areas and/or disciplines?*

2. *In the differentiation according to scientific discipline and/or research area, how is the international reputation of journals from German science publishers rated?*

3. *What measures, if any, could be important in strengthening the reputation of journals from German publishers?*

Over 1,800 journals are regarded as important

When asked to name the main scientific journals with an international reputation, respondents named more than 1,800 different titles. The same journals were often mentioned in different scientific disciplines. Taking into account these multiple attributions, the number of periodicals named in each scientific discipline was as follows: 630 in the humanities and social sciences, 410 in the life sciences, 488 in the natural sciences, and 499 in the engineering sciences. Table 3.07 lists the ten most frequently named journals in each discipline.

Just over half of all respondents (51 %) confirmed the existence of German scientific journals with a strong international reputation. At the same time (cf. Table 3.08), a relatively high number of respondents (more than 32 %) did not acknowledge that journals from German publishing houses had a renowned international status in their scientific discipline.

Table 3.07:
Most important scientific journals (number of mentions)

Journal Title	Number of Mentions
Humanities and Social Sciences	
Historische Zeitschrift	18
Journal of Personality and Social Psychology	12
Geschichte und Gesellschaft	12
Zeitschrift für Soziologie	10
Kölner Zeitschrift f. Soziologie u. Sozialpsychologie	10
Euphorion – Zeitschrift für Literaturgeschichte	9
Language	8
American Economic Review	8
American Journal of Sociology	8
Zeitschrift für Pädagogik	8
Life Sciences	
Nature	96
Science Magazine	71
Cell	42
The Journal of Biological Chemistry online	30
Proceedings of the National Academy of Sciences of the United States of America	26
Journal of Neuroscience	18
The Journal of European Molecular Biology Organisation (EMBO)	18
The Journal of Immunology	18
Nature Medicine	18
The New England Journal of Medicine	18
Natural Science	
Physical Review Letters	92
Nature	72
Science Magazine	61
Angewandte Chemie, International Edition	34
Physical Review B	32
Journal of the American Chemical Society	31
Applied Physics Letters	23
Journal of Chemical Physics	20
Journal of Geophysical Research	17
Chemistry – A European Journal	16
Engineering Sciences	
Applied Physics Letters	13
Journal of the American Ceramic Society	11
Acta Materialia	9
SIAM Journal on Computing	9
Journal of the ACM	9
AIChE Journal	9
IEEE Transactions on Communications	8
Journal of Fluid Mechanics	8
Chemical Engineering Science	8
Physical Review Letters	7

A total of 17 % of all respondents said that they were unable to answer this question. The majority of those who were persuaded of the excellence of German scientific journals were academics in the humanities, social sciences and natural sciences. Approximately 59 % of the academics in these disciplines supported this view, significantly above the average. In the engineering sciences, almost half of the respondents agreed. Finally, a mere 35 % of the life scientists surveyed felt that German academic journals in their field had an international reputation.

If a comparison is made by research area within the disciplines, significant differences emerge:

> Around 71 % of the humanities scholars confirm the existence of high-ranking academic journals from German publishers in their research area, although among social and behavioural scientists this falls to 42 %. It is mainly theologians (89 %), art historians (88 %), academics from the field of

Table 3.08:
Existence of journals from German publishers with internationally high reputation (in percent)

	Yes	Don't know	No	**Total**	Count (n)
Humanities and Social Sciences					
Humanities	71.2	14.4	14.4	**100.0**	118
Social and Behavioural Sciences	41.8	19.4	38.8	**100.0**	98
Life Sciences					
Biology	41.7	16.7	41.7	**100.0**	108
Medicine	27.0	21.6	51.4	**100.0**	111
Agriculture, Forestry, Horticulture, Veterinary Medicine	61.5	0.0	38.5	**100.0**	13
Natural Science					
Chemistry	68.3	12.9	18.8	**100.0**	101
Physics	47.4	15.8	36.8	**100.0**	95
Mathematics	65.5	20.7	13.8	**100.0**	29
Geosciences / Earth Sciences	59.6	15.8	24.6	**100.0**	57
Engineering Sciences					
Mechanical Engineering, Production Technology	59.3	25.9	14.8	**100.0**	27
Heat Energy Technology, Process Engineering	64.3	17.9	17.9	**100.0**	28
Materials Science	61.1	19.4	19.4	**100.0**	36
Electrical Engineering, Computer Science, System Engineering	39.1	10.9	50.0	**100.0**	92
Construction Engineering, Architecture	33.3	46.7	20.0	**100.0**	15
Total	**50.9**	**16.9**	**32.2**	**100.0**	**928**

Basis: 1,028; No response: 100
Question 7: In your research area, are there any journals from German publishers with an internationally high reputation?

ethnology, religious studies and non-European cultures (83 %) and specialists in the field of ancient cultures (80 %), who claim to know of German academic journals of international standing. In the social and behavioural sciences only 41 % of the economists, 40 % of the social scientists and 39 % of the psychologists believe that there are any internationally recognised German periodicals in their subjects.

> In the life sciences, 62 % of the scientists in the agricultural and forestry sciences, horticulture and veterinary medicine accorded an international reputation to German academic journals, followed by 42 % of the biologists. The zoologists stated that all of the German scientific journals in their profession were prestigious and of international importance. Microbiologists, virologists and immunologists (21 %) and medical biologists (26 %) were least in agreement with this point of view.

> In the natural sciences, chemists in particular viewed German journals as having a good international reputation. A total of 89 % of the molecular chemists and 80 % of the scientists who conduct research on the chemistry of biological systems were of a similar opinion, as were 66 % of the mathematicians.

> Finally, in the engineering sciences internationally renowned German journals were recorded in particular in the field of heat energy technology and process engineering (64 %) and in the materials sciences (61 %), but by few of the computer scientists (35 %).

It was interesting to compare the previous answer, to the question about which were the overall most important journals in the different disciplines, to the answer to this question. In both cases certain journals were mentioned several times by respondents from different scientific disciplines. Including these multiple references, the humanities and social sciences academics named 200, in the life sciences 89, in the natural sciences 143, and in the engineering sciences 103 journals.

The ten most frequently mentioned journals grouped under this heading are listed in Table 3.09 by scientific discipline. Because of the large number of journals mentioned and the variety of specialist publications in each specific sub-discipline, a comparison with the internationally relevant periodicals listed above is of only limited relevance. In the humanities and social sciences, five of the German journals referred to above are also included among the first ten most frequently mentioned academic journals; three journals from the natural sciences occur in both lists.

When almost half of the respondents disagree that there are internationally renowned scientific journals in the ownership of German publishers, or express no opinion, this also poses the question of whether and how this situation can be improved. Table 3.10 presents an assessment of the different proposals.

> 73 % of all respondents approve of more frequent publication of English-language articles. In most scientific disciplines the approval rating was high, ranging between 71 % and 86 %. However, only 52 % of the humanities scholars and social scientists were in favour of such a measure. This is consistent with the importance attributed to the German language by this group for accessing and publishing their research results (see section 3.4).

Table 3.09:
Most important scientific journals from German publishers
(Number of mentions)

Journal Title	Number of Mentions
Humanities and Social Sciences	
Historische Zeitschrift *	11
Kölner Zeitschrift für Soziologie und Sozialpsychologie *	7
Euphorion. Zeitschrift für Literaturgeschichte *	6
Geschichte und Gesellschaft *	5
Zeitschrift für Soziologie *	5
Zeitschrift für Kunstgeschichte	4
Zeitschrift der Deutschen Morgenländischen Gesellschaft	4
Deutsche Vierteljahreszeitschrift für Literaturwissenschaft und Geistesgeschichte	4
Zeitschrift für Assyriologie	4
Deutsches Archiv für Erforschung des Mittelalters	4
Life Sciences	
Planta	96
Plant Biology	71
Molecular Genetics and Genomics	42
Cell & Tissue Research	30
Journal of Comparative Physiology A	26
Naturwissenschaften	18
Oecologia	18
Journal of Biological Chemistry	18
Flora	18
European Journal of Cell Biology	18
Natural Sciences	
Angewandte Chemie, International Edition *	55
Chemistry – A European Journal *	14
Mathematische Annalen	9
Mathematische Zeitschrift	9
European Journal of Organic Chemistry	9
Inventiones Mathematicae	8
International Journal of Earth Sciences	8
Synthesis	7
Applied Physics Letters *	6
Contributions to Mineralogy and Petrology	6
Engineering Sciences	
Zeitschrift für Metallkunde	7
Chemie Ingenieur Technik	6
Experiments in Fluids	6
Advanced Engineering Materials	5
AEÜ International of Electronics and Communications	5
Frequenz	4
at – Automatisierungstechnik	4
Advanced Materials	4
Angewandte Chemie. International Edition	4
Materialwissenschaft und Werkstofftechnik	4

Journals marked with '*' also rank among the top 10 internationally most important journals

> 71 % of all respondents asked for more frequent publication of works by leading international research scientists from other countries. Here too the 59 % approval rating from the humanities scholars and social scientists is lower than that of other disciplines.

> 63 % suggested stricter quality criteria when selecting studies for publication. The number of those in favour in the different disciplines varies between 57 % and 60 %; only the life scientists consider such a course of action to be absolutely necessary or necessary, with 78 %.

> 61 % considered that increased advertising of German academic journals is imperative or necessary. There are no great differences between the approval ratings in the different scientific disciplines.

> 7 % of the respondents believed that scientific journals from German publishers could become more attractive if they paid higher author fees.

More articles in English

The approval rating of established researchers for these suggestions differed from that of young researchers. Established researchers asked for more frequent publication of English-language articles or more frequent publication of articles by leading foreign research scientists. Only in the engineering sciences was the ratio reversed: Here 90 % of the young research scientists, but only 76 % of the established research scientists were in favour of more English-language articles; in addition, 79 % of the young researchers, but only 70 % of the established researchers thought that the works of foreign research scientists should be published more often, in order to strengthen the reputation of journals from German publishers.

Young researchers as a rule are more in favour of using appropriate advertising measures, albeit only slightly more frequently than their established colleagues. However, there is a clear difference in the humanities and social sciences. Here 67 % of the established researchers argued in favour of more active promotion of German academic journals within the scientific community, compared to only 47 % of the young researchers.

Table 3.10:
Measures needed to enhance the international reputation of scientific journals from German publishers
(in percent, multiple references allowed)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Publish more articles in English	51.7	85.7	71.0	77.8	**72.9**
Publish more articles by leading foreign research scientists	58.7	79.7	72.6	70.4	**70.6**
Stricter quality criteria in selecting articles	59.7	78.2	57.0	58.5	**63.4**
Use appropriate advertising measures	62.8	65.5	58.5	57.2	**61.0**
Pay higher fees to authors	12.1	4.5	4.3	5.4	**6.5**
Count (n)	223	233	268	204	**928**

Basis: 1,028; No response: 100

Question 8: In your opinion, what measures are needed to strengthen or enhance the international repurtation of scientific journals from German publishers in your research area? (Answer category 1= 'absolutely necessary' to 5 = 'not necessary'; categories 1 and 2 combined).

More young researchers in the humanities and social sciences and in the life sciences approve of higher royalties than their established colleagues. In the natural sciences, as many as 14 % of young researchers were in favour, in contrast to only 3 % of the established scientists. A reversal of this trend can be seen in the engineering sciences. Here 6 % of the established researchers would like higher author royalties, but none of the young researchers.

When asked to provide further suggestions on how the deficit in the international reputation of scientific journals from German publishers could be remedied, 77 respondents replied. Their answers were made more in the form of summary comments than complementary suggestions. A relatively frequent comment was that in view of international scientific cooperation a question about journals from German as opposed to international publishers, about German versus international journals, was of somewhat secondary importance. There were occasional suggestions to add parallel translations in English or summaries in English of certain articles in German scientific publications; other recommendations included using international reviewers and including international members on publishers' committees.

The approval rating for the different suggestions varies above all against the background of the perceived existence or absence of German academic journals of high standing. According to whether the existence of these periodicals is confirmed or denied, suggestions for improving their international reputation vary: Amongst respondents who found no renowned scientific journals of German provenance in their field, 86 % argued for more publication of English articles, compared to just 63 % of those who did find such journals. That more frequent articles from leading foreign research scientists would contribute to their international reputation was believed by 78 % of those who thought there were no German journals of international standing on the science market, but by only two-thirds of respondents who do know of renowned German journals in their field.

The question arose as to whether experience and expertise in the publication of periodicals influenced the recommendations for how to improve the international reputation of scientific journals from German scientific publishers. The survey indicated that this was not the case. For example, the same percentage of researchers with or without publishing experience (73 %) were in favour of more frequent inclusion of English-language articles; 64 % of those involved in publishing such journals argued for stricter quality criteria when selecting manuscripts for publication, along with 63 % of those persons not involved in such activities.

4 Open access in scientific communication

4.1 Awareness of open access initiatives and declarations

After examining the publishing habits of DFG-funded researchers and their ways of accessing information through conventional channels, and questions relating to the reputation and status of international and German scientific journals, it was interesting to compare researchers' experiences with and opinions on open access publishing. In view of the increasing level of debate on this topic, in various national and international institutions and scientific committees, the first question that arises is how familiar scientists and academics are with these discussions. In order to find out, various statements and initiatives were listed at

Table 4.01:
Knowledge of national and international declarations and initiatives for promoting open access (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Berlin Declaration on Open Access in Science and Humanities					
Good knowledge	6.9	4.8	6.7	1.9	**5.2**
Not in detail	30.0	33.3	32.0	28.4	**31.1**
No knowledge	63.1	61.8	61.3	69.8	**63.7**
All	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number (n)	233	243	295	213	**984**
Budapest Open Access Initiative					
Good knowledge	3.0	1.2	2.0	0.9	**1.8**
Not in detail	11.6	11.5	9.2	9.9	**10.5**
No knowledge	85.4	87.2	88.8	89.2	**87.7**
All	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number (n)	231	245	294	213	**983**
Bethesda Statement on Open Access Publishing					
Good knowledge	1.3	4.9	1.0	1.4	**2.1**
Not in detail	10.4	26.9	11.9	7.5	**14.3**
No knowledge	88.3	68.2	87.1	91.1	**83.5**
All	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number (n)	233	242	293	211	**979**
Open Archives Initiative					
Good knowledge	1.3	3.7	2.4	1.9	**2.3**
Not in detail	21.5	27.3	22.5	19.9	**22.9**
No knowledge	77.3	69.0	75.1	78.2	**74.8**
All	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number (n)	232	244	295	212	**983**
Public Library of Science					
Good knowledge	3.9	22.1	5.1	2.8	**8.5**
Not in detail	24.6	36.5	27.5	22.2	**27.9**
No knowledge	71.6	41.4	67.5	75.0	**63.6**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	232	244	295	212	**983**

Question 10: There have been a number of national and international declarations and initiatives promoting open access. Which ones are you familiar with?

the beginning of this part of the questionnaire, and the respondents asked to rate their knowledge of them. Overall, it was revealed that only slightly more than half of the scientists and academics surveyed had heard of the open access declarations and initiatives listed in the questionnaire. A total of 47 % admitted that they had never heard of any of the declarations and initiatives. However, the level of awareness of individual initiatives varied according to scientific discipline, which is easily explained by the different orientation of these initiatives. The best known are the Public Library of Science[1] and the Berlin Declaration[2], both of which had at least been heard of by 36 % of all respondents. However, only 5 % of the respondents stated that they were very familiar with the Berlin Declaration, and 9 % said the same in relation to knowledge of the Public Library of Science – considering the high percentage of 22 % in the life sciences, towards whom the initiative is directed. A quarter of the respondents said that they had heard of the Open Archives Initiative[3]. A total of 16 % are familiar with the Bethesda Declaration[4] and 12 % with the Budapest Initiative[5]. Table 4.01 gives details of the knowledge of the different declarations and initiatives by individual discipline.

4.2 Use of open access publications

4.2.1 Publication forms in open access

The types of publication that can be uniquely subsumed under the term open access are not always clear or generally applicable. In order to ensure a uniform understanding and comparability of the answers provided in the study, the questionnaire defined open access publications as those that, unlike conventional publications, can be accessed for free over the internet. A distinction was also made between the "golden" and "green" roads to open access, i.e. access to articles in open access journals and self-archived open access publications (preprints and postprints). The question relating to the rights granted in connection with open access publications, which are an important component of most open access definitions, was deliberately not addressed in the terminology used here. The distinctions made were as follows:

Conventional publications:

Publications of scientific works – monographs, journal articles, contributions to edited volumes, etc. – that readers can access in printed or digital form in return for a fee.

Open access publications:

Scientific works that are accessible to all readers for free over the internet and whose quality is generally ensured in the same way as with conventional publications, through peer review.

1. *http://www.plos.org/*
2. *http://www.zim. mpg. de/openaccess-berlin/BerlinDeclaration_dt.pdf*
3. *http://www.openarchives.org/index.html*
4. *http://www.earlham.edu/~peters/fos/bethesda.htm*
5. *http://www.soros.org/openaccess/read.shtml*

Open access publications are typically found in these forms:

Open access journal articles
Peer-reviewed scientific articles that can be accessed for free by readers via special internet journals.

Electronic postprints
Originally conventional publications that, after initial publication, are placed on the internet by their authors where they can be accessed for free.

Electronic preprints
Advanced publications of scientific studies that have not yet undergone peer review, made available by their authors for free access over the internet.

4.2.2 Knowledge and use of open access journals

Approximately 38 % of the research scientists surveyed are familiar with open access journals (cf. Table 4.02). Divided into scientific discipline, this reveals the following distribution:

> In the humanities and social sciences 42 % of the humanities scholars are familiar with open access journals, compared to 36 % of the social and behavioural scientists. A total of 53 % of the historians and about 50 % each of the fine arts academics, linguists and educationalists use open access journals.

> In the life sciences 52 % of the biologists and 46 % each of the medical biologists and agriculturalists, forestry scientists, horticulturalists and veterinarians are familiar with open access journals. In the natural sciences the level of awareness varies from 43 % in the geosciences, to 46 % in mathematics and 47 % in physics. These journals are much less well known in the field of chemistry. Only 29 % of the chemists surveyed said that they knew of any open access journals.

> Compared to other scientific disciplines, the level of awareness of open access journals in the engineering sciences is relatively low. In electrical engineering, computer science and system engineering, 34 % of the respondents know of this form of publication; the highest percentage here is among computer scientists, at 51 %. In mechanical engineering and production engineering, 31 % of the scientists said they knew about open access journals, compared to just 13 % in the area of heat energy technology and process engineering. In the areas of civil engineering and architecture this type of publication is completely unknown.

Table 4.02
Knowledge of open access journals - by scientific discipline
(in percent)

Scientific discipline	Yes	No	**Total**
Humanities and Social Sciences	38.9	61.1	**100.0**
Life Sciences	47.6	52.4	**100.0**
Natural Science	40.3	59.7	**100.0**
Engineering Sciences	24.2	75.8	**100.0**
Total	**38.3**	**61.7**	**100.0**

Basis: 1,028; No response: 32
Question 11: Are you familiar with any open access journals in your research area?

Table 4.03:
Most important scientific open access journals
(Number of mentions)[1]

Title of Open Access Journal	Number of Mentions
Humanities and Social Sciences	
H-Soz-u-Kult – Kommunikation und Fachinformation für die Geschichtswissenschaften	7
sehepunkte	5
Zeithistorische Forschungen. Studies in Contemporary History	4
Forum Qualitative Sozialforschung	4
Zeitenblicke	3
The Bryn Mawr Classical Review	3
The British Museum Studies in Ancient Egypt and Sudan (BMSAES)	2
Forum historiae iuris	2
Göttinger Forum für Altertumswissenschaft	2
Historicum	2
Life Sciences	
Public Library of Science - Biology	17
Public Library of Science – unspez.	9
BioMed Central	3
The Journal of Clinical Investigation	3
German Medical Science	3
The Journal of Biological Chemistry online [k]	3
Journal of Biology	3
Journal of Neuroscience [k]	2
Science Magazine	2
BMC Biology (BioMed Central)	2
Natural Science	
New Journal of Physics	23
Documenta Mathematica	7
Atmospheric Chemistry and Physics (ACP)	4
e-Polymers	4
Optics Express	4
Annals of Mathematics [k]	3
Advances in Theoretical and Mathematical Physics [k]	2
Condensed Matter Physics	2
Geometry & Topology	2
BMC Structural Biology (BioMed Central)	2
Engineering Sciences	
Journal of Artificial Intelligence Research	6
Chicago Journal of Theoretical Computer Science [k]	3
Journal of Machine Learning Research	2
Electronic Colloquium on Computational Complexity	2
Logical Methods in Computer Science	2
Journal of Artificial Societies and Social Simulation	1
European Plastic News	1
SIGKDD Explorations	1
The Internet Journal of Medical Simulation	1
Agricultural Engineering International: The CIGR Journal of Scientific Research and Development	1

[1]Some of the journals named as open access journals by the scientists and academics in the study are only partially available free of charge on the Internet (as at April 2005). In this case older issues are usually free, but payment is required for the latest issue or issues published in the current year. Titles affected are marked with the superscript 'k' to indicate payment (sometimes) required. Journal titles that can only be accessed free of charge under certain conditions (for example membership of an institution) and journals which only provide abstracts for free were mentioned relatively frequently, but were not included in this summary table.

Established research scientists are more familiar with open access journals than young researchers. The difference in the natural sciences and life sciences is around 13 %, in the engineering sciences around 14 %. Clearer differences are shown in the humanities and social sciences, in which 43 % of the established researchers know of these journals, but only 20 % of the young researchers.

An overview of the subject-specific open access journals regarded by respondents as particularly important, broken down by scientific discipline and including naming frequency, is given in Table 4.03. Taking into account any multiple references to individual journals by the different scientific disciplines, the total number of periodicals named was as follows: 64 in the humanities and social sciences, 69 in the life sciences, 91 in the natural sciences, and 57 in the engineering sciences.

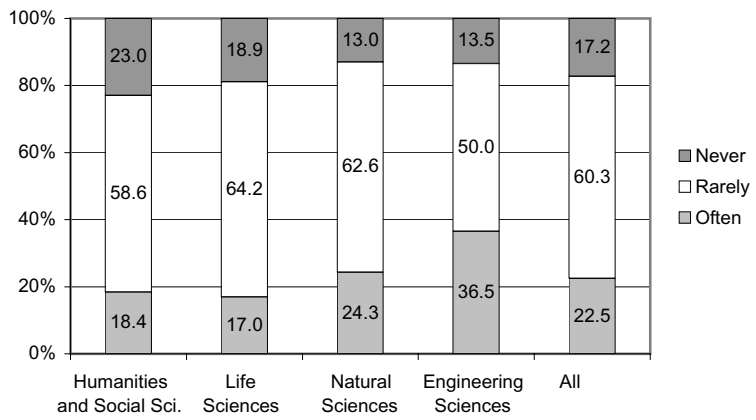
Of the 381 research scientists who knew of open access journals, 360 provided information about how frequently they used this form of publication. Accordingly, around 83 % accessed their information more or less frequently from open access journals (cf. Figure 4-1).

Most users of open access journals can be found in the natural sciences

The use made of these journals in the individual scientific disciplines varies considerably: Most users of open access journals are to be found in the natural sciences, closely followed by respondents from the engineering sciences – although the latter have a higher frequency of use (allowing for the fact that general awareness of open access journals in the engineering sciences is quite low, cf. Table 4.02). In the life sciences and in the humanities and social sciences, the use of open access journals and frequency of use by individual researchers falls slightly. The highest portion of scientists who are familiar with open access journals but do not use them can be found in the humanities and social sciences, at 23 %.

Complementary to the question on use and frequency of use is the question on publishing practices in open access amongst the research scientists surveyed.

Figure 4-1:
Frequency of use of open access journals (in percent)



Basis: 381 respondents, who know other OA Journals in their Research Area
No response: 21
Question 13: How often do you use open access journals as a source of information?

According to their own statements, a total of only 122 respondents have ever published one or more articles in open access journals. (cf. Figure 4-2)

In comparison to overall publishing activity, only a few articles in open access journals

If a comparison is made between the figures presented in section 3.1 concerning the total number of journal articles published in the last five years with the number of articles published in open access, a clear difference emerges: While each of the scientists surveyed published an average of around 19 specialist articles during this period, the number of contributions to open access journals was on average less than one (cf. Table 4.04).

Most publications in open access journals were in the field of the natural sciences; natural scientists are therefore in first place, even in comparison to the total number of articles they publish, followed by respondents from the engineering sciences. The fewest number of articles in open access journals came from the humanities and social sciences.

Figure 4-2:
Knowledge and use of open access journals (number of respondents)

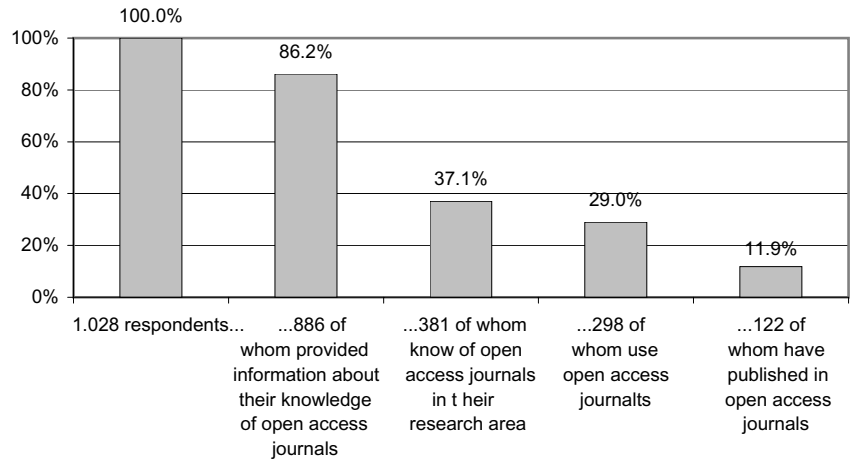


Table 4.04:
Total number of journal articles published during the last five years
(arithmetic mean and standard deviation)

		Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	Total
Total number of journal articles	m	13.0	21.0	22.9	17.9	19.1
	s	13.3	17.6	19.8	20.5	18.5
Of which in open access journals	m	0.2	0.3	0.8	0.6	0.5
	s	0.5	1.5	3.7	2.1	2.4
Count (n)		**203**	**217**	**280**	**202**	**902**

Basis: 1,028; No response: 126
Question 14: In the last five years: how many articles have you published ? Do these include any that have appeared in open access journals?

4.2.3 Free postprints (secondary publications)

Self-archiving, the process in which authors provide their scientific work on the internet for free following conventional publication, plays a larger role than publication in open access journals. Here authors not only make journal articles accessible free of charge, but other publications as well. In all 317 respondents had used this method of making their studies available in open access.

Self-archiving, the process in which authors provide their scientific work on the internet for free following conventional publication, plays a larger role than publication in open access journals

The percentage of this type of secondary publication varies between the scientific disciplines and individual types of publication (cf. Table 4.05). In the case of journal articles, the order of importance among the disciplines is similar to that of publication in actual open access journals. Natural scientists use the method of postprint publication for journal articles the most frequently. Approximately 20 % of the articles originally published in conventional form are republished on the internet, compared to 18 % in the engineering sciences, 13 % in the life sciences, and just 6 % in the humanities and social sciences.

Approximately one-fifth of the articles originally published in conventional form are republished on the internet

Contributions in conference proceedings and edited volumes and monographs are additionally published in open access especially often by engineering scientists. More than a quarter of engineering contributions in conference proceedings and 16 % of the articles in edited volumes are made accessible free of charge in this way. The percentage for monographs is nearly 15 %.

A differentiated analysis reveals that the proportion of studies published secondarily as postprints can vary considerably between specialist fields and subjects:

> In the humanities and social sciences, it is mostly social and behavioural scientists who use the option of secondary open access publication for their academic studies. While they make around 9 % of the articles published in journals available for free on the internet, this is done by only 3 % of the humanities scholars surveyed [1].

Table 4.05:
Percentage of articles published by scientific publishers in conventional form that have also been published on the Internet
(arithmetic mean of percentage value)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Journal articles	5.9	12.3	20.1	17.6	**14.4**
Papers in proceedings	7.7	4.4	20.4	26.0	**16.5**
Contributions in edited volumes	3.5	4.5	12.9	16.2	**8.6**
Monographs	2.7	5.4	15.0	14.7	**7.7**
Other publications	5.9	9.1	20.0	28.6	**13.3**
Total (n)	**59**	**60**	**104**	**94**	**317**

Basis: 317 respondents had published postprints; No response: 0
Question 16: In some cases, scientific publishers allow articles that have already been published conventionally to be republished on the Internet (electronic postprints) - e.g. on author's homepage, institute homepage, etc. In the last five years: how much of your work have you published in conventional media, in other words used publishers to offer them to readers in printed or digital form against payment, and how many of these have you (or your publishers) also made available for free access on the Internet?

1. *On this and the following table series: Deutsche Forschungsgemeinschaft (2005). Publikationsstragien im Wandel. Tabellenband. http://www.dfg.de/zahlen_und_fakten/ evaluation by research area, in particular Table 16c*

> Among the life scientists it is biologists in particular, who make 17 % of their journal articles available as postprints; in medicine the proportion is 8 %, and among agriculturalists and forestry scientists, horticulturalists and veterinarians 7 % of journal articles published conventionally are republished as electronic postprints in open access. The latter republish around 9 % of their articles that have previously appeared in proceedings via electronic media, among biologists this is 7 %, for medical biologists 1 %. Amongst biologists, the preferred method of secondary publication of other forms of publication is usually the internet.

> In the natural sciences, it is above all researchers in the field of mathematics who republish a large number of their studies over the internet. According to respondents' statements, 32 % of their journal articles, 33 % of their papers in proceedings and 27 % of their contributions to edited volumes are accessible for free as secondary publications on the internet. Physicists make around 25 % of their independent publications available again in open access, thereby achieving for monographs, almost as high a rate of secondary publication as mathematicians for journal articles (31 %).

> In the engineering sciences it is the computer scientists who stand out, with two-thirds of their articles in conference proceedings, 46 % of their journal articles, almost 42 % of their contributions to edited volumes and nearly 24 % of their monographs republished on the internet.

Young researchers are more likely to make their studies available as free secondary publications than established research scientists. While around 13 % of young researchers provide secondary publications over the internet, only 6 % of established researchers do.

Postprints can be made available to readers as free secondary publications of scientific articles in various ways. Publishing opportunities include one's own

Table 4.06:
Suitable places to publish electronic postprints (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Author's homepage	70.3	63.6	77.0	78.0	**72.3**
Institute homepage	51.6	62.4	55.7	73.9	**60.5**
University server (library, computer centre)	51.9	57.8	44.1	44.4	**49.5**
Subject/discipline-specific archive on the Internet	79.7	77.6	82.1	70.8	**78.0**
Count (n)	202	214	259	191	**866**

Basis: 1,028; No response: 162
Question 17: If publishers allowed conventional publications also to be published for free access on the Internet, where in your opinion would be the best place for this? (Answer category 1= 'very suitable' to 5 = 'not at all suitable'; categories 1 and 2 combined).

1. *Vgl. zu diesen und den nachfolgenden Ausführungen Tabellenband: Deutsche Forschungsgemeinschaft (2005). Publikationsstrategien im Wandel? Tabellenband. http://www.dfg.de/zahlen_und_fakten/ Auswertungen nach Fachgebiet, insbesondere Tabelle 16c*

homepage or the website of the institution of employment, university servers or subject-specific internet archives. In answer to the question of what is the best place on the internet for secondary publications, most researchers argued in favour of a subject or discipline-specific archive (cf. Table 4.06).

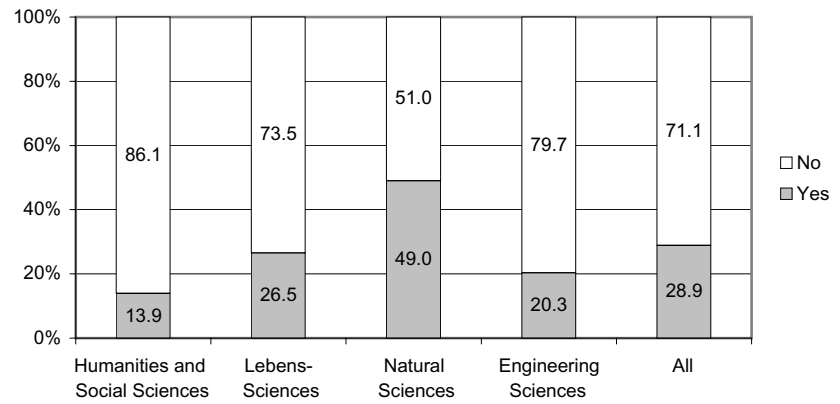
The second most popular places for presentation were the author's own homepage, followed by the website of their institution where they work and university document servers. Only engineering scientists believe that publishing postprints on the author's or institute's own website is better than publishing in subject-specific internet archives.

4.2.4 Preprints in open access

Only a quarter of the scientists surveyed are familiar with preprint servers

Preprint archives enable scientific studies to be made available to a wider public before final publication. A total of 29 % of the scientists surveyed had heard of these archives. This amounted to approximately half of the natural scientists, about one-quarter of the life scientists, only around one-fifth of the engineering

Figure 4-3:
Knowledge of electronic preprint archives for own subject (in percent)



Basis: 1.028; No response : 174
Question 18: In some subjects it is possible to make interim results of scientific research available in an electronic archive for downloading free of charge from the Internet (preprints).
Do you know of any such electronic archives in your subject?

Table 4.07:
Number of preprints of scientific studies in electronic archives
(arithmetic mean and standard deviation)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Arithmetic mean	6.7	4.6	13.1	4.1	**9.9**
Standard deviation	5.8	4.9	11.4	3.0	**10.2**
Count (n)	15	21	86	19	**141**

Basis: 149 respondents who know of electronic preprint archives in their subject (filter from Question 18)
No response: 8
Question 19: In the last five years: during this period, have you yourself published any such preprints in an electronic archive? If so, how many?

scientists, and only 14 % in the humanities and social sciences, in which this form is uncommon (cf. Figure 4-3).

Of the 247 researchers who had heard of preprint archives, 239 gave information about their use: Around 62 % of these respondents had already placed electronic preprints in these archives. Natural scientists use this resource the most (71 %). Of the generally low number of humanities scholars and social scientists who knew of this method of prepublication, almost 60 % have used it to publish their work, compared to 53 % of the engineers and 50 % of the life scientists (cf. Table 4.07). A total of 141 of the scientists surveyed gave information about the publications they had already published on the internet.

On average each of these respondents had published approximately 10 studies as preprints. In the natural sciences the average is 13 studies, in the humanities and social sciences it is 7. Life scientists and engineers published an average of 5 and 4 preprints, respectively.

4.3 Assessment and recommendations for open access

In the assessment of open access a clearly ambivalent attitude amongst the respondents can be observed. From the point of view of easier access to scientific information, the respondents welcome the opportunities of this type of access and publication, but from a research organisation point of view many remain sceptical. It is noteworthy that the less experience a respondent has had of the medium, the greater the scepticism. And vice versa, the more open access is used, the fewer the reservations.

A set of scaled statements about open access was employed to obtain a general overview of views on the subject. These were mainly statements taken from the current debate. Respondents who believed that they could not give an opinion on individual aspects could note this separately. In an initial step, the various statements were reduced to five areas, which can be combined under the following keywords: Information Facilitation, Bibliographical Presence, Scientific and Organisational Reputation and Quality Assurance. Grouped into these categories, Table 4.08 first lists those statements that respondents in each scientific discipline agreed with more strongly.

Access to scientific studies above all for researchers from developing countries

The statement that open access will facilitate access to scientific studies above all for scientists and academics from developing countries largely influenced the answers listed under "Information Facilitation". This item not only had the highest approval rating of all the aspects in the first group, but overall, including in the individual scientific disciplines. Both of the other statements were a long way behind. Based on approval ratings, they lie in fifth and seventh place respectively of all the statements rated here.

Fears that a lack of citation and poor bibliographic references in comparison to conventional publications could lead to open access publications having a negative impact on a scientist's career

In the ranking of all items, the statements grouped under the "Bibliographic Presence" category were far ahead in second, third and fourth place. Humanities scholars and social scientists and life scientists agreed most strongly with the critical views of open access listed here. However, it must be remembered, as demonstrated in other sets of questions (Table 4.02), that it is precisely these scientific disciplines that have relatively little experience with open access. These answers may be based on the fear that a lack of citation and poor bibliographic references in comparison to conventional publications would lead to open access publications having a negative impact on their professional scientific

career. The more these fears predominate, the more the inclination to publish in the new medium will decline. It is therefore not surprising that it is precisely the young researchers who tend to agree with these statements more than established researchers. Confirmation of this supposition can be found in the assessment of the items grouped under "Scientific and organisational reputation". With a small measure of variation between the disciplines, more than half of all respondents believed that open access publications were not taken sufficiently into account in the assessment either of scientific work or of funding proposals.

Young researchers are more likely than their established colleagues to assume a lack of consideration for open access publications in funding proposals. It is noticeable, however, that they are somewhat less likely to agree with the statement that such publications were insufficiently taken into account in the assessment of scientific studies than their established colleagues. A total of 66 % of the established researchers agreed with this statement, compared to only 63 % of the young researchers [1].

With regard to the statements grouped under "Organisational Integrity", the main fear was that the long-term availability of open access publications was not guaranteed, a concern expressed by 59 % of all respondents.

Table 4.08:
Agreement with various statements on the topic of open access (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Facilitates access to scientific studies for researchers in developing countries	87.1	90.3	86.7	85.0	**87.3**
Contributes to the improvement of access to scientific knowledge	68.7	74.4	66.5	65.9	**68.8**
Contributes to long-term change of scientific publishing industry	56.7	61.1	66.8	58.6	**61.4**
Open access is too little known as a publishing medium	85.0	82.7	79.8	81.3	**82.0**
Citation is rarer than with conventional publications	80.1	74.8	67.0	71.4	**73.1**
Bibliographic referencing is rarer than with conventional works	78.5	65.5	66.5	67.9	**69.8**
Insufficiently considered in assessment of individual scientific achievement	67.7	70.9	60.3	62.4	**65.2**
Insufficiently considered in proposals for funding	59.5	68.2	47.8	56.0	**57.7**
Long-term availability cannot be guaranteed	66.9	56.5	55.3	59.3	**59.3**
Authors should have better copyright protection through licences	67.4	60.0	56.3	49.2	**58.2**
Quality assurance is just as guaranteed as with conventional publications	30.1	52.7	38.9	40.3	**40.2**
Total (n)	**203**	**222**	**272**	**193**	**890**

Basis: 1,028; No response: 138
Question 20: Here we have assembled a series of statements on the topic of open access that are often mentioned in the current debate. Which do you agree with? (Answer category 1= 'strongly agree' to 5 = 'strongly disagree'; categories 1 and 2 combined).

1. *Cf. Table series: Deutsche Forschungsgemeinschaft (2005). Publikationsstrategien im Wandel. Tabellenband. http://www.dfg.de/zahlen_und_fakten/ assessments by research area, in particular Table 20a*

Humanities scholars and social scientists in particular, who often need access to works published many years ago for their research, were among those most worried about this, at around 67 %.

Only 40 % of the researchers surveyed think that the same peer review quality can be assured for research made available in open access as for those in conventional publications. Again it was the humanities scholars and social scientists who least agreed with this statement, at only 30 %.

Table 4.09 shows that the figures given above reflect the researchers' doubts, as opposed to their actual experiences. The more experience the researchers had of open access, the lower the level of scepticism.

> That open access publications are cited or referenced in bibliographies less frequently, is confirmed by around 35 % and 31 % of experienced open access users. The number of sceptics rises markedly amongst occasional or non-users.

> Correspondingly rare was the view expressed by frequent users as opposed to other respondents, that open access publications had a worse reputation than conventional publications. However, around 46 % of respondents with experience of open access still concluded that these publications were not sufficiently taken into account in the assessment of individual scientific performance. To a lesser extent this was also considered a handicap when submitting funding proposals.

Table 4.09:
Agreement with various statements on the topic of open access by user type (in percent)

	Often use open access journals	Seldom use open access journals	Know open access journals, but don't use them	Know no open access journals in my research area	**Total**
Facilitates access to scientific studies for researchers in developing countries	81.3	91.4	95.2	85.3	**87.1**
Contributes to the improvement of access to scientific knowledge	85.3	73.2	60.5	65.2	**68.7**
Contributes to long-term change in scientific publishing industry	77.4	59.9	62.8	59.1	**61.2**
Open access is too little known as a publishing medium	52.4	75.9	78.3	88.7	**82.1**
Citation is rarer than with conventional publications	34.5	67.3	90.0	82.1	**73.8**
Bibliographic referencing is rarer than with conventional works	30.9	67.2	88.5	77.8	**70.7**
Insufficiently considered in assessment of individual scientific achievement	45.8	57.3	60.0	72.7	**65.1**
Insufficiently considered in proposals for funding	34.9	51.9	68.8	64.7	**57.8**
Long-term availability cannot be guaranteed	37.3	57.1	64.9	63.1	**59.3**
Authors should have better copyright protection through licences	54.0	53.4	62.9	59.6	**57.7**
Quality assurance is just as guaranteed as with conventional publications	62.7	45.2	34.4	32.8	**40.0**
Total (n)	**69**	**205**	**50**	**528**	**852**

Basis: 1,028; No response: 176
Question 20: Here we have assembled a series of statements on the topic of open access that are mentioned repeatedly in the current debate. Which do you consider to be correct and which not? (Answer category 1= 'strongly agree' to 5 = 'strongly disagree'; categories 1 and 2 combined).

> A total of 63 % of experienced users of this medium indicated that the quality of open access publications is ensured as thoroughly as for conventional publications. A level of scepticism still remains among other user groups.

> Remarkably, well over half of the respondents who have extensive experience of open access publications believe that the authors of these publications should receive more copyright protection. The assessment of this statement varies only slightly between the different types of user.

82 % of all respondents argue for support

Despite relatively little experience with open access and many individual reservations, the overwhelming majority of scientists surveyed think that promoting the publication and use of scientific studies in open access is a good idea. Here differences between the scientific disciplines play a more subordinate role. In all, 82 % of all respondents argue for support (cf. Table 4.10).

Table 4.10:
Approval of promotion and use of scientific studies in open access
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**All**
Yes	80.7	88.2	83.8	73.6	**81.9**
No	19.3	11.8	16.2	26.4	**18.1**
Total	100.0	100.0	100.0	100.0	**100.0**
Number (n)	**228**	**238**	**302**	**216**	**984**

Basis: 1,028; No response: 44
Question 25: In principle, do you think that the publication of scientific studies in open access should be encouraged or not?

Table 4.11:
Preferred measures for supporting open access (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Encourage debate about open access in universities and research institutes	74.0	78.9	69.7	69.9	**73.1**
Improve advice and information in the area of open access for research scientists	74.1	73.7	67.1	68.0	**70.6**
Improve the provision of training courses and publishing techniques for research scientists	44.7	35.2	23.1	25.8	**41.6**
Research scientists should be asked to make their own work available on the Internet	70.1	69.7	74.1	71.2	**71.5**
Author contracts should allow free publication on the Internet	67.4	65.3	70.2	70.6	**68.4**
Incentives for publishers to make their publications available on the Internet free of charge	87.3	86.4	86.4	84.2	**86.2**
Set up free, centralised, discipline-specific archives on the Internet	80.9	71.9	73.4	66.0	**73.2**
Funding should be directed at competitiveness with conventional journals	65.5	86.3	75.7	69.9	**75.0**
Total (n)	**183**	**208**	**250**	**157**	**798**

Basis: 806 respondents think that open access should be encouraged (filter after Question 25)
No response: 8
Question 26: Which of these measures for supporting open access do you agree with?
(Answer category 1= 'strongly agree' to 5 = 'strongly disagree'; categories 1 and 2 combined).

To determine what form of specific support the respondents felt would be most reasonable was measured using a set of eight statements.

Grouped under these categories and differentiated by scientific discipline, Table 4.11 presents the approval ratings of respondents for the different statements.

In first place among the recommendations, and without any significant differences between the scientific disciplines, was a proposal made by around 86 % of all respondents to offer incentives to "established" publishing bodies to make the articles they publish conventionally also available free of charge on the internet. In second place was a recommendation to set up centralised, open access discipline-specific archives on the internet, where suitable research could be stored and downloaded. The highest approval rating for this idea came from the humanities scholars and social scientists and the natural scientists. In third place, and proposed mainly by humanities scholars and social scientists and life scientists, was a recommendation to promote the discussion of open access in universities and research institutes; natural and engineering scientists were less enthusiastic about this statement.

5 Scientific publishing: cost aspects

The subscription costs of scientific journals have risen sharply in the last few years. The literature written about the "journals crisis" also reflects on whether and how a purely electronic publication can reduce production costs and whether the business models discussed under the heading of open access can relieve the procurement budgets of libraries in particular[1]. Against the background of these discussions, the researchers in the study were asked to state whether, and if applicable to what extent, they had already had to contribute to the costs of publishing their work. They were also asked whether authors would be prepared to subsidise the publication of their research results out of their research budgets, in order to make these publications available for free to an interested readership. Finally, they were asked to rate various alternatives for financing open access publications.

5.1 Author fees for science publications

Personal contributions to publication costs currently vary considerably between scientific disciplines

Around 43 % of all respondents have had to contribute once or more than once to the costs of publishing their work in scientific journals. Just over half of the 1,000 respondents (cf. Table 5.01) indicated that they had not so far had to pay any author fees. However, the differentiation between the individual scientific disciplines varies considerably.

While only about 9 % of the humanities scholars and social scientists have previously had to contribute to the costs of publishing their work, the percentages were much higher in the other disciplines, with 25 % in the engineering sciences, 50 % in the natural sciences and 80 % in the life sciences.

> Whereas 3 % of the humanities scholars have had to contribute to publication costs, this applies to 13 % of social and behavioural scientists.

> In the engineering sciences, 30 % of the researchers in the area of heat energy technology and process engineering were the most likely to have contributed to publication costs, compared to 11 % in the area of mechanical engineering and production engineering (11 %).

Table 5.01:
Contributions made to cost of publishing own scientific work in journals
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Yes	8.8	79.7	50.3	24.7	**42.7**
No	91.2	20.3	49.7	75.3	**57.3**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	226	251	304	219	**1.000**

Basis: 1,028; No response: 28
Question 22: Have you ever had to pay money to publish your own work in a journal - either in open access or conventionally?

1. *Cf.: Odlyzko, A.: The Economics of Electronic Journals. in: First Monday 1997. http://firstmonday.org/issues/issue2_8/odlyzko/index.html*

> In the natural sciences, author fees are quite common. Approximately 64 % of the geoscientists and 57 % of the physicists have had to contribute to publication costs either once or more than once, compared to just 6 % of the mathematicians.

> Respondents in the life sciences were most often asked to contribute to their publication costs: 82 % of the medical biologists and 75 % of the biologists have had to subsidise the publication of their work. The lowest percentage – although still at 57 % – was in the agricultural and forestry sciences, horticulture and veterinary medicine.

This analysis also revealed that author fees have to be paid almost exclusively for publications in conventional journals (cf. Table 5.02). Fees for open access publications were paid by less than 2 % of all respondents.

The amount of fees required from authors in the vast majority of cases was in the range of up to € 500. Certain respondents in the life sciences did however state that they had had to pay author fees as high as € 4,800.

As shown in Table 5.03, the payment of author fees for open access publications is currently rare. However, the questionnaire also asked whether researchers were basically willing to contribute to publication costs out of their own research budgets, if publishing their work in this way could make it available free of charge to an interested public.

Although around 42 % of the respondents supported paying some of the publication costs out of their research budgets, 58 % rejected the idea. Once again there were significant differences between individual scientific fields, research areas and disciplines:

> Three-quarters of the 216 respondents from the humanities and social sciences who replied to the question relating to this topic rejected the idea of authors

Table 5.02:
Subsidies made to cost of publishing scientific work in journals
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
No payment of subsidies	92.8	22.1	52.2	77.5	**60.0**
Extra payment only for conventional journals	7.2	75.3	46.0	21.1	**38.5**
Extra payment only for open access journals		0.4	0.7		**0.3**
Extra payment for both conventional and open access journals		2.2	1.0	1.4	**1.2**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	222	231	289	213	**955**

Basis: 1,028; No response: 73
Question 22: Have you ever had to pay money to publish your work in a journal - either in open access or conventionally?
Question 23: If you have paid to publish your work - either in conventional or open access journals: please indicate how many articles and approximately how much you had to pay.

contributing to the costs of open access publications. This may be due to the fact that the overwhelming majority of these respondents had not previously had to subsidise the costs of their publications in any way [1].

Less willingness to contribute to publication costs in the humanities and social sciences and in the engineering sciences

> Life scientists show the most willingness to contribute to open access publication costs. Above all respondents from the area of biology responded positively to this idea with 64 %. As many as 70 % of researchers in basic biology and medicine agreed.

> Slightly fewer of the natural scientists were willing to contribute to the costs of freely accessible publications. However, the most sceptical were the mathematicians, 89 % of whom rejected this type of contribution.

> Finally, 65 % of the engineering scientists surveyed rejected the idea of financing the costs of publishing journal articles from their own research budgets in order to make them available to interested readers free of charge. Researchers in the area of mechanical and production engineering expressed the most reservation to the idea (77 %).

If a comparison is made between the more or less normal practice in the different scientific disciplines of contributing to publication costs and the willingness to use their own research budgets for open access publication, some parallels emerge (cf. Table 5.04). In essence, it appears that the less frequently respondents had been asked to pay author fees for publications, the less willing they were to contribute financially to open access. Despite this synchronicity, a few differences can be observed in the survey results:

> Although so far only 7 % of the humanities scholars and social scientists have had to contribute financially to the cost of publishing their journal articles, nearly a quarter were ready to do so if it meant that their work could be accessed for free over the internet.

Table 5.03:
Author fees paid for conventional publications or for open access publications
(arithmetic mean of percentage value)

	Humanities and Social Sciences		Life Sciences		Natural Sciences		Engineering-Sciences		**Total**	
	Conv.	OA	Conv.	OA	Conv.	OA	Conv.	OA	**Conv.**	**OA**
Up to € 250 per jl. article	81.1		24.0		37.8	20.0	53.3	66.7	**35.1**	**21.4**
Between € 251 and € 500	8.3		37.8	16.7	34.0	60.0	30.1	33.3	**34.2**	**35.7**
Between € 501 and € 1,000	8.4		24.2	50.0	20.5	20.0	8.6		**20.2**	**28.6**
Between €1,001 and € 2,000	2.2		12.3	16.7	7.3		5.9		**9.3**	**7.1**
More than € 2,000			1.7	16.7	0.5		2.1		**1.2**	**7.1**
Total	**100.0**		**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	16		179	6	136	5	48	3	**379**	**14**

Basis: 393 respondents had paid to publish their own work (filter after Question/Sub-question 22)
No response: 0
Question 23: If you have paid to publish your work - either in conventional or open access journals: please indicate how many articles and approximately how much you had to pay.

1. *Cf. above Table 5.02*

Table 5.04:
Willingness to finance journal articles out of own research budget
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Not willing	75.0	36.9	58.3	64.7	**58.1**
Up to € 250 per journal article	22.2	36.9	29.0	28.4	**29.3**
Between € 251 and € 500 per article	2.3	19.1	9.7	6.5	**9.7**
Between € 501 and € 1,000 per article	0.5	5.0	2.4	0.5	**2.2**
Between € 1,001 and € 2,000 per article		1.7	0.3		**0.5**
More than € 2,000 per article		0.4	0.3		**0.2**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	216	241	290	215	**962**

Basis: 1,028; No response: 66

Question 21: Would you as the author be prepared to finance journal articles out of your research budget, if these were then made available to an interested public free of charge?

> Life scientists have had to contribute most frequently to financing the publication of their work and also constitute the highest proportion of those respondents who were willing to use resources from their own research budgets to pay for free access to their journal publications (63 %). However, the willingness of the life scientists to pay author fees for conventional publications is greater than that of paying to finance articles in open access.

> The situation in the natural sciences is similar, where 48 % of the respondents have previously contributed to the costs of publishing an article in a conventional publication, but only 42 % of whom are ready to pay to publish articles in an open access publication.

> Finally, 36 % of the engineering scientists would be prepared to pay author fees for a publication in open access, although only 23 % of them had already paid author fees for conventional publications.

5.2 Funding models

In section 5.1 it was shown that 42 % of all respondents are prepared to enable the publication of their work in open access through contributions from their research budgets [1]. However, if other sources of funding were available, not surprisingly most respondents would prefer the costs to be transferred to third parties, for example their institutions of employment or funding organisations (cf. Table 5.05).

At over 72 %, the vast majority of respondents argued in favour of the costs of publishing in open access journals being taken over by scientific funding organisations. Funding bodies provide open access journals with financial support, so that researchers can publish in them without incurring additional costs. This

1. Cf. above Table 5.04

statement received the highest approval rating in all scientific disciplines. The DFG has already taken this route through the publication grant, the use of which is discussed in more detail in the next section.

Table 5.05:
Preferred funding models to ensure free access to scientific journal articles
(in percent, multiple references allowed)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Authors pay a fee - out of their research budget	9.0	24.6	15.2	8.3	**14.6**
Institutions of employment pay membership fees to open access operators - all employees can then publish there free of charge	39.4	55.7	46.5	36.8	**45.0**
Scientific funding bodies or similar provide open access journals with financial support, so that researchers can publish in them free of charge.	71.5	75.2	75.3	64.9	**72.1**
Count (n)	227	233	285	209	**954**

Basis: 1,028; No response: 74

Question 24: Several funding models are currently under discussion in connection with options for making scientific journal articles available to users free of charge. Which of the following models would you prefer? (Answer category 1= 'strongly approve' to 5 = 'strongly disapprove'; categories 1 and 2 combined).

6 Publication funding by the DFG

6.1 Revision of the publication grant policy

In 2001 the DFG revised its guidelines for publication funding. Funding for publication of project results can now be applied for directly within the scope of the actual project. This publication grant, which amounts to a maximum of € 750 a year, can be saved over the duration of a long-term project and supplemented by reallocating funds from other project titles. The project leader can choose the form of publication at will [1].

Approximately 60 % of all respondents were aware of the revised policy. However, only 43 % of the engineering scientists surveyed (cf. Table 6.01) were aware of the publication grant, compared to over 60 % in the other scientific disciplines.

Knowledge of the new guidelines also varies within the individual scientific disciplines.

Six out of ten respondents are familiar with the revised publication grant policy

> 68 % of the humanities scholars and 60 % of the social and behavioural scientists indicated that they knew about the amendment.

> In the life sciences 71 % of the biologists had heard of the new regulations. Researchers in the area of medicine were the least well informed, at 61 %.

> In the natural sciences, it is mainly representatives in the research areas of physics and geosciences, each with 74 %, who had heard of the modified guidelines, while knowledge was lowest amongst chemists, at 60 %.

> In the engineering sciences, knowledge of the new policy varies considerably between research areas: 63 % of the materials scientists and 50 % of the mechanical and production engineers, but only 39 % of heat energy technology and process engineers and 35 % of electrical engineers, system engineers and computer scientists had heard of the amendment.

Table 6.01:
Awareness of DFG policy of publication funding of December 2001
(in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Yes	63.9	66.0	64.7	43.4	**60.2**
No	36.1	34.0	35.3	56.2	**39.8**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count (n)	233	247	303	221	**1.004**

Basis: 1,028; No response: 24
Question 27: Are you aware of this policy?

1. *Cf. DFG "Research Grants" form 1.02 -II3 (section 5.1)*

6.2 Application for and use of the publication grant

Approximately 97 % of the researchers who had heard that the publication grant had been introduced provided information about applying for it. According to this, 46 % of these researchers have already applied for funds to publish their research results within the context of a project.

Although just over half of the humanities scholars and social scientists and life scientists who knew about the policy had also applied for a publication grant, only 31 % of the engineering scientists and about 43 % of the natural scientists had done so.

Figure 6.1 shows the percentage of scientists who had either applied, or not applied, for a publication grant, and the percentage of publication grants awarded or denied, by individual scientific discipline.
Of those who were awarded a publication grant, approximately three-quarters opted to save the funds during the duration of the project (cf. Table 6.02). Of these, 57 % have not yet used the publication funds they received, a further 18 % have saved at least some of the funds, and the remaining 26 % have already spent the funds.

The differences between the scientific disciplines in terms of actual use of the publication grant are clear. Almost three-quarters of the humanities scholars and social scientists, about half of the life and natural scientists, and 40 % of the engineering scientists (cf. Table 6.03) save these funds for use at a later date. The connection with the forms of publication favoured by each discipline is evident. Thus 85 % of the humanities scholars and social scientists stated that they had used or intended to use the publication grant to print monographs; in the other scientific disciplines this form of publication plays a much smaller role. In comparison, 85 % of the life scientists, 73 % of the natural scientists and 67 % of the engineering scientists use the grant to cover the costs of publishing their work in conventional journals, which play a much less important role in the humanities and social sciences.

Finally, approximately 17 % of the 66 natural scientists who responded said that they used the publication grant to publish their research results in open access

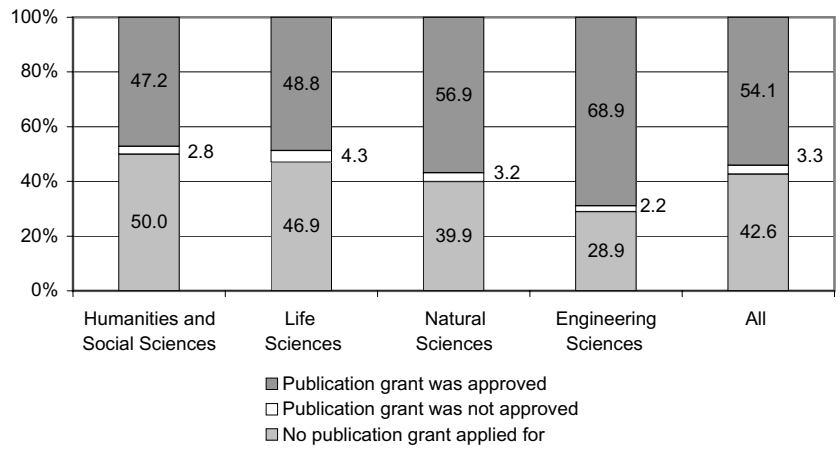
Table 6.02:
Use of grants from the publication fund (in percent)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**All**
Already spent	16.9	32.4	27.8	24.0	**25.6**
Some already spent - some saved	9.9	14.9	22.2	36.0	**17.8**
Not yet spent	73.2	52.7	50.0	40.0	**56.6**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Number (n)	71	74	72	25	**242**

Basis: 249 respondents have received a grant from the publication fund (filter from Question 28)
No response: 7
Question 29: Have you already spent the grant you received from the publication fund or have you saved the money?

journals. Across all scientific disciplines nearly 8 % of the respondents indicated that they have used the DFG funds to publish scientific work in open access journals.

Figure 6-1:
Application and approval of a publication grant (in percent)



Basis: 604 (filter from Question 27)
No response: 20
Question 27: Have you applied for a publication grant since 2001?

Table 6.03:
How publication funds from the DFG were used
(in percent, multiple references allowed)

	Humanities and Social Sciences	Life Sciences	Natural Sciences	Engineering Sciences	**Total**
Printing costs for publishing in monograph(s) / edited volume(s)	85.3	10.3	12.1	19.0	**34.5**
Publication costs in conventional commercial journals	16.2	85.3	72.7	66.7	**58.7**
Costs for technical work for publishing in conventional journals	13.2	29.4	30.3	23.8	**24.2**
Publication costs in open access journals	1.5	5.9	16.7	4.8	**7.6**
Other purposes	2.9	2.9	1.5	14.3	**3.6**
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**
Count(n)	68	68	66	21	**223**

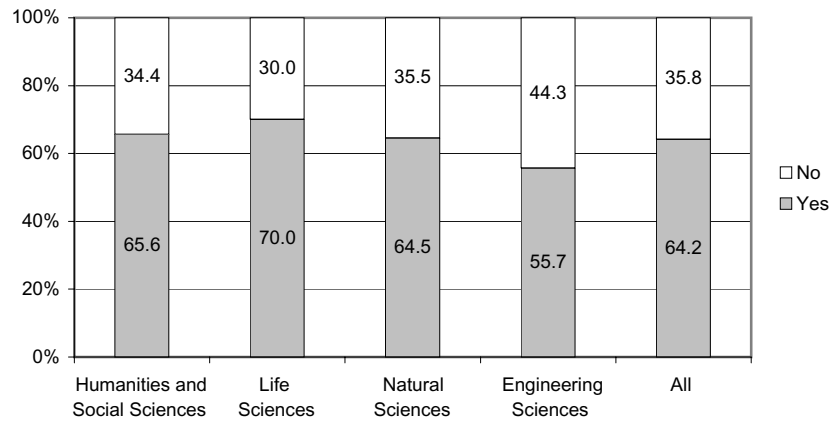
Basis: 249 respondents had received a grant from the publication fund (filter from Question 28)
No response: 26
Question 30: For what purpose have you used the grant or, if you have not yet spent the money or have saved some of it, what do you intend to use it for?

7 Funding of open access by the DFG

Although the number of actual open access publications across all scientific disciplines is still very low (cf. Figure 4.2), almost two-thirds of all respondents were in favour of the DFG giving greater financial support to open access publications (cf. Figure 7-1). Young researchers in the life, natural and engineering sciences are more in favour of funding open access than their established colleagues, while in the humanities the situation is precisely the reverse [1]. Obviously, this situation is influenced by the fact that in the humanities and social sciences there are as yet only very few open access journals of renown through which young researchers can be sure of boosting their visibility and thereby their career opportunities. On the other hand, the importance of the habilitation or the "second book" may arguably explain those reservations towards the open access concept. Open access is mainly discussed in the context of journal publications and is likely to be championed by researchers in the fields in which the "journals culture" is the dominant communication channel.

Finally, it should be noted that researchers who use open access journals more frequently are also more strongly in favour of open access publications being promoted by the DFG. In the group of researchers who use open access journals frequently, the approval rate is 80 %, and amongst those who use them rarely, 69 %. However, approval for greater support of open access publication by the DFG is still 58 %, even in the group of those who do not know of any open access journals (cf. Figure 7-2).

Figure 7-1:
Approval for greater promotion of publications in open access by the DFG
(in percent)



Basis: 1.028; No response: 56
Question 31: In your view, should the DFG promote open access publications more strongly?

1. *Cf. Table series: Deutsche Forschungsgemeinschaft (2005). Publikationsstrategien im Wandel . Tabellenband: http://www.dfg.de/zahlen_und_fakten/ evaluations by scientific discipline and status, in particular Table 25*

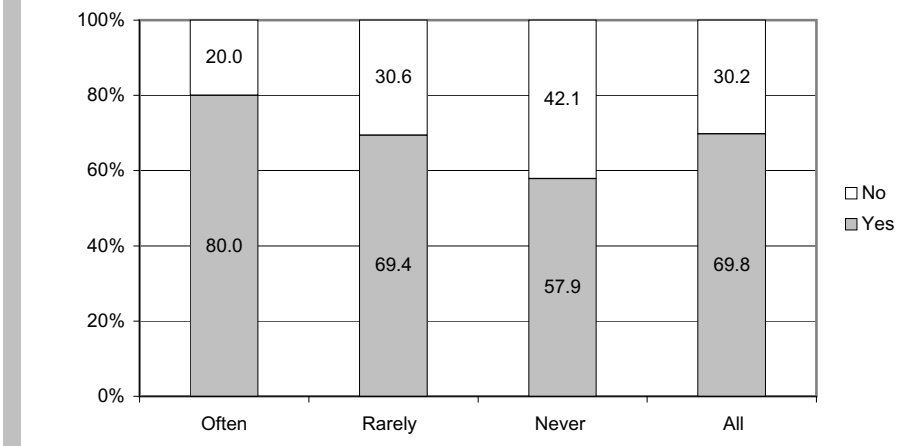
In this context the previous assessments on an overall trend to support open access should be noted [1]. Approximately 75 % of the respondents were in favour of supporting open access journals in such a way as to enable them to compete with conventional scientific journals. These results reveal a great willingness to support open access publications that is largely irrespective of the amount of experience they have with it.

From the statements about the criteria the researchers and academics applied when choosing a suitable publication for their own work, further details emerge about organisational and technical aspects that should be taken into account in the promotion of open access publications:

> One of the main aspects determining the choice of certain journals as a place of publication for one's own work is the long-term availability of the periodicals in question. This criterion was considered important or very important by over 60 % of all respondents, even in the sometimes "fast-moving" life and natural sciences. This requirement of being able to find and quote from publications over the long term therefore merits special attention in the case of electronic publications.

> The shortest possible interval between the submission and publication of manuscripts was considered important by almost 60 % of the respondents. How far this interval could be reduced in the case of online publications through the elimination of technical aspects, such as prepress and printing and a basically open print run for individual issues of a journal, remains to be seen, but might be perceived as an advantage. Also, this should not ignore the criterion that has significantly higher priority, that of a thorough peer review process, which is often the reason for lengthy delays in publication.

Figure 7-2:
Approval for greater promotion of publications in open access by the DFG by existing frequency of use of open access journals
(in percent)



Basis: 360 respondents know of open access journals in their research area (Question 11) and have indicated how often they use these journals

1. *Cf. above Table 3.03*

> A third aspect lies in the area of publication costs. At least 23 % of the respondents considered this criterion to be important or very important in their deliberations when choosing a suitable publisher. The statements reported above about alternative means of financing open access publications substantiate the importance of this criterion [1].

Respondents were then asked to record any suggestions or comments about the promotion of open access by the DFG. Altogether 165 respondents responded to this issue. The most frequent comments related to the issue of costs or expanded on aspects covered in the standard part of the questionnaire: The DFG should introduce appropriate measures to combat the low level of awareness and impact factor of open access publications and press for rigorous peer reviewing in open access archives. A considerable number of comments included the suggestion to set up subject-specific open access archives and make them available via centralised institutions, for example from the DFG website. However, there were only few practical suggestions about where such archives could be hosted. Although formats tend to vary according to approach, many respondents suggested driving forward the standardisation of text and other formats ("specification of a standard format for contributions, possibly including format details") in order to facilitate publication in open access. These formats should be centrally available. Additional recommendations that were addressed directly to the DFG are given below, in no particular order:

> The DFG, together with experts from the different subject communities, should pursue this issue and intervene more actively in the scientific community. At the same time, the German Rectors' Conference should be approached in order to actively include the universities in the discussion.

> The DFG should provide facilities for open access publication for the different research and funding areas in the form of a research archive.

> The DFG should draw up a "positive list" of suitable open access journals. This list should only include journals that use the highest peer review standards. The publication costs of any author whose manuscript is accepted for publication there should be borne by the DFG. At the same time, open access journals must be continually evaluated for maintenance of quality standards and their respective publication costs.

> The DFG should endeavour to persuade as many publishing houses as possible to allow authors to place their publications on the internet, as a general rule, not just in individual cases. A list describing the legal position of different journals would be helpful [2].

> The DFG should make it a condition of all funding programmes that publications produced within the framework of a DFG-funded project must be made available for free via open access servers. The DFG should (possibly in cooperation with other research organisations) provide open access servers and guarantee the permanence of these servers and thus the long-term availability of the publications placed there.

1. *Cf. above Table 5.05*
2. *A list of publishers' terms and conditions and methods of secondary publication can be found at http://www.sherpa.ac.uk/romeo.php*

> The DFG could lead the way, for example with a publication of its own (on an open access basis), with its international partners, such as the US National Science Foundation, the European Science Foundation, etc.

> The DFG receives a final report for each project, which is already largely in the format of a publication and is also reviewed by the DFG. It would be useful to make these reports or parts of them available online to the public for free (e. g. via GEPRIS). This would have the advantage that negative research results would also be published, something that the existing publication system cannot adequately afford.

> In connection with the secondary publication of their own work on the internet, it would be useful for researchers if public funding bodies would guarantee them legal support. This could be in the form of a paragraph in the award letter expressly forbidding that the copyright in a publication be exclusively transferred to a publishing house. So far it is practically impossible for individual researchers to persuade publishing houses to limit their usage rights and thereby provide legal protection for internet distribution of their publications.

> Contracts for publications resulting from projects funded by the DFG should allow publication both in conventional media and in open access; here it would have to be ensured that publishers were in agreement with this.

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