Article

Journalism
12(7) 794–813

DOI: 10.1177/1464884911412702
jou.sagepub.com
SAGE

Slaves to journals, serfs to the web: The use of the internet in newsgathering among European science journalists

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Abstract
This article describes the first survey of European science journalists working for general national print media and news agencies in 14 different countries of the European Union. The survey was carried out through the internet and calls for participation were sent to 208 journalists from 102 different media. Answers were received from 97 science journalists, a response rate of 46.6 percent. After the survey, interviews with 12 of the respondents were conducted.

The main conclusion is that not only are science journalists becoming more dependent on scientific journals in their daily reporting, they are also spending a lot of time on the internet – 3.5 hours a day, on average – an activity that increases the concentration on breaking news and prevents them from going outside the newsroom to write more feature stories. In consequence, readers are receiving a distorted image of science as a series of 'discoveries' or 'breakthroughs', distant from the real daily world of scientists and the scientific process.

This dependency on the internet, and on 'ready-to-write' press releases from scientific journals, is threatening science journalism, as professionals are controlled by the same embargoes, are using the same sources and visiting the same sites, no matter what country they are working in. This loss of information diversity is a consequence of the introduction of the internet in newsrooms, but also a result of the increasing media awareness of science sources.

Keywords
Europe, internet, interviews, journalists, newsgathering, routines, science journalism, survey

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> 'We're slaves to journals. It's very hard to make a case for ignoring it in a given week.' Susan Okie, *Washington Post* medical writer, to Kurtz (1991)

> 'Most medical reporters are slaves to the journals. The journal system is destructive of good reporting.' Tom Siegfried, science editor of the *Dallas Morning News*, to Shaw (2000)

Introduction

The main source of information for science journalists is the scientific articles published in peer-reviewed journals (Entwistle, 1995; Hansen, 1994; Hotz, 2002; Van Trigt et al., 1994; Veneu et al., 2008; Weitkamp, 2003; Williams and Clifford, 2009). Most of the time, these scientific journals send press releases to reporters calling their attention to some articles in the upcoming editions. According to research done on this subject, journal articles described in press releases are more likely to generate newspaper stories on the same topic (Bartlett et al., 2002; De Semir et al., 1998; Stryker, 2002)

Science journalists may feel manipulated by these press releases, but they admit their dependence on pre-selected news, coming from scientific publications (Nelkin, 1987; Williams and Clifford, 2009). Journal editors know this. They have long understood the way journalists work and the need they have for reliable information on science. And they gladly provide that information. Scientific journals are also competing with each other (Jaffe, 2002) and they know how important it is to get media coverage (Elías, 2008).

There is no doubt that the internet is also changing the newsgathering procedures of journalists (Curtin and Rhodenbaugh, 2001; Gans, 2010; Hu and Sundar, 2010; Morton, 1996). From 1994 to 1995, the percentage of reporters who said that the internet was their preferred newsgathering tool increased from 25 to 45 percent (Garrison, 1997). The percentage of US newspapers with a circulation of 20,000 or more that used online resources increased from 57.2 percent in 1994 to 95.1 percent in 1998, and newspapers who declared they were using the web daily or more often increased from 27.4 percent to 63.2 percent in the same period (Garrison, 2000).

Craig Trumbo and his colleagues conducted two surveys of members of the National Association of Science Writers (NASW), in the United States, and found that the use of email and the web increased significantly between 1994 and 1999 (Trumbo et al., 2001). Subsequent in-depth interviews with 20 respondents to this survey concluded that 'E-mail and the Web are having a tremendous impact on the practices of science journalism and on the lives of science writers' (Dumlao and Duke, 2003).

Science institutions and scholarly journals understood from the early days of the internet the importance this new tool could have in the dissemination of science news. Thirty-three years ago, long before the democratization of the web, Tuchman (1978: 18) observed that 'reporters tend to gather around places where stories might be expected to occur, such as central police stations and courts processing crimes'.

The central source of science news appeared in May 1996, when the American Association for the Advancement of Science created Eurekalert!. Sources paid up to $1000 dollars a year to have their embargoed materials posted on the site; journalists paid nothing to access that information (Marshall, 1998). However, to be allowed into

the site, journalists must at all times respect the embargoes decided by the news promoters and, if they do not, permission to access the information will be cancelled. Another important source of science news and press releases on the internet is the European rival of Eurekalert! – AlphaGalileo – which was launched in September 1998, with the promise of being 'an effective one-stop shop for news on European science, engineering and technology' (Green, 1998).

From the point of view of the science institutions, the internet has greatly increased their capacity to reach wider audiences. In 2000, Sharlean Duke conducted a survey of 244 NASW members (125 responses) who identified themselves as public relations practitioners. She found that 66 percent of the respondents considered email 'essential' in their relations with journalists and 86 percent agreed that the web had improved their work (Duke, 2002).

More recently, some authors have probed into other forms of science communication through the internet, such as weblogs or Twitter (Brumfiel, 2009; Walejko and Ksiazek, 2010). By not following traditional journalistic rules, most of which tend to control the information offered to the public (Kiernan, 2006), bloggers bring new voices and add complexity to online science news.

Methodology

Although there is a considerable bibliography on science news, there have been few scientific studies involving European science writers. Moreover, several aspects of the constraints science reporters face while doing their job need to be clarified. This article presents the results of the first survey of science journalists working on staff for news agencies and general print media in 14 countries of the European Union.

Not included in this survey are radio, television or freelance science journalists – mainly because their constraints and routines are somewhat different from print staff journalists. We've also decided not to include science journalists working for specialized magazines, because they work in a completely different environment, where science is not competing with other issues for space. Their audiences are different, their pace of work too.

In March 2003, we started gathering information about science journalists working on staff for general print media and news agencies in all the countries of the European Union.[1] From the very beginning, it was clear that this was not an easy task, mainly because there was no centralized information on these journalists. The website for the European Union of Science Journalists' Associations (EUSJA)[2] seemed a good place to start, but we soon realized that very few of these national associations had an up-to-date or reliable directory of their members.

Having discarded the possibility of officially obtaining a complete list of science journalists in each country, we turned our attention to personal contacts, in order to achieve this objective. The EUSJA site, together with the sites of some of the science journalists' national associations, gave us some very good information on where to start. From then on, the process was similar to each and every country: email one science journalist, ask her/him the names of other science journalists in his/her newspaper/magazine/agency, and the names of other science journalists in other media, specifying, in each case, that contacts should be on staff in printed press or news agencies.

University researchers in some of these countries were also contacted, in order to understand if all (or almost all) the general print media in a given country were covered by the list we had. This double-checking was also done with science journalists themselves, so we could be sure the list was as inclusive as possible and was not overlooking some important media or journalists.[3]

The survey was closed on 9 February 2004, with 97 respondents (46.6%).[4] To deepen our work, we decided to randomly interview some of the journalists who answered the survey. In order to get a diverse set of interviewees, we separated the journalists who answered the survey into three different groups, according to the number of hours spent on the internet per day while at work. From each of these groups, we randomly chose four people to be interviewed, for a total of 12 interviews.

After the sampling, we usually contacted the respondents by email, in order to ask them for the interview. If they refused, or didn't answer after three email messages, we would randomly choose another person from that same group and did the same procedure, until completing four interviews for each group. To achieve the final number of 12 interviews, a total of 23 journalists were contacted.

To randomize the sample, we gathered the subjects in three different lists and chose to contact every third person. Every list was perceived as a continuous loop, so we would not run out of possible interviewees every time the end of the list was reached. The 12 interviews for this project were conducted by telephone, from 22 April 2005 to 9 June 2005, in English.

Characterization of the respondents

The science journalists who responded to this questionnaire came from 14 different countries of the European Union. Table 1 shows the number of respondents per country. It was not possible to identify a single science journalist working on staff for a general print media or news agency in Luxembourg. At the same time, only one Irish science journalist could fill the pre-set conditions for this survey.

Because the number of journalists who answered the questionnaire was too low to allow a country by country analysis, we decided to divide these journalists into three different and bigger groups, according to the Gross National Income (GNI) per capita of their respective countries.[5]

Gross National Income (GNI) is the key indicator for classifying regions in the research works conducted by international organizations, such as the World Bank and the United Nations (World Bank, 2003). GNI per capita is considered a 'summary indicator', because it is directly related with a series of other indicators as health, education, access to communication technologies, and so on. Other studies on the public understanding of science, for instance, have clustered EU countries around industrialization (Durant et al., 2000). However, the weight of the industrial sector in developed countries has dropped in the last few years, which means that the levels of industrialization are no longer closely linked with GNI per capita. This fact and the realization that GNI per capita is increasingly used as a 'summary indicator' to measure the relative development of countries led us to choose it as a variable in this study.

Table 1. Origin of the science journalists who responded to this survey

Countries	Number of answers	Percent
Austria	6	6.2
Belgium	5	5.2
Denmark	5	5.2
Finland	6	6.2
France	8	8.2
Germany	8	8.2
Greece	4	4.1
Ireland	1	1.0
Italy	14	14.4
Netherlands	12	12.4
Portugal	9	9.3
Spain	8	8.2
Sweden	6	6.2
UK	5	5.2
Total	**97**	**100.0**

In the first group, we joined countries with a GNI per capita lower than 22,000 USD (Spain, Greece and Portugal); in a second group, countries with a GNI per capita higher than 22,000 USD but lower than 28,000 USD (France, Germany, the UK, Italy, Finland and Sweden). Finally, in the third group, countries with a GNI per capita higher than 28,000 USD (Denmark, Ireland, Austria, the Netherlands and Belgium). Table 2 shows the groups formed by this division.

The first conclusion that can be drawn from the results of this survey is that the majority of European science journalists[6] is male, but not for long. Although 63.9 percent ($N = 62$) of the respondents to this survey are male, we can notice that the number of women becomes higher as we move towards the younger journalists. See Table 3.

The mean age of the science journalists who responded to this questionnaire was 42.7 years old (Median = 42.5; Standard deviation = 10.0). Males ($N = 61$) were older (mean = 44 years old) than females ($N = 35$; mean = 40 years old), although the results are not statistically significant.[7] The youngest was a Portuguese female journalist (aged 26) and the oldest was a French male journalist (aged 64). Countries with a GNI per capita lower than 22,000 USD present the lowest mean age (36.1 years old) when compared with

Table 2. Number of respondents according to GNI per capita of their country

GNI per capita	Number of cases	Percent
< 22,000 USD	21	21.6
22,000–28,000 USD	47	48.5
> 28,000 USD	29	29.9
Total	**97**	**100.0**

Table 3. Sex of science journalists according to age

	Sex		
	Male	Female	Total
25–34 years	14	13	27
35–44 years	17	10	27
45–54 years	18	9	27
55–64 years	12	3	15
Total	**61**	**35**	**96**

Note: χ^2 (3) = 3.932, $p > 0.05$

countries with a GNI per capita between 22,000 and 28,000 USD (mean = 46.4 years old) and with countries with a GNI per capita higher than 28,0000 USD (mean = 41.5 years old), a statistically significant result.[8]

Most respondents ($N = 66$; 68.8%) to this survey worked for daily newspapers and only a small percentage for weekly magazines or news agencies. The surveyed journalists also had a very strong journalistic experience. The respondents' mean number of years working as a journalist was 17.3. Males were more experienced (mean = 18.8 years) than females (mean = 14.7 years), a statistically significant result.[9] In countries with a GNI per capita lower than 22,000 USD (Spain, Greece and Portugal) the mean number of years as a journalist was 12.7. In all the other countries of the EU (GNI per capita higher than 22,000 USD), the mean number of years as a journalist was 18.5, also statistically significant.[10]

The mean number of years the respondents had been working as science journalists is 11.9 (median = 10.0; SD = 8.2). Females were less experienced in this field than men, showing a mean of 9.7 years of experience as science journalists, against 13.1 years of experience for males.[11] Again, there is a difference between journalists from countries with a GNI per capita lower than 22,000 USD (9.9 years of experience as science journalists) or higher than 22,000 USD (12.4 years of experience).[12] The majority of the respondents to the survey (42.7%) had a first university degree. A Master's was held by 22.9 percent and a PhD by 13.5 percent of the respondents.

Survey results

What do science journalists use the internet for? This was our first question in the survey. Respondents were confronted with 11 possible answers and asked to check all that applied. Results for this question can be seen in Table 4.

We also asked respondents how much time they spend daily on the internet, at home and at work. Our results show that European science journalists spend around 40 minutes per day on the internet at home ($N = 96$; SD = 1.22) and 3.5 hours ($N = 95$; SD = 2.26) at work. While at home, 46.9 percent of the journalists do not use the internet at all and 35.4 percent use it for 30 minutes to one hour.

Table 4. What do you use the internet for?

Use of the internet	Number of answers	Percent
Article research, reference material	93	95.9
Reading publications online	87	89.7
Contacting sources	78	80.4
Finding new sources, experts	76	78.4
Reading email	76	78.4
Searching for press releases	75	77.3
Story ideas	66	68.0
Downloading still images	59	60.8
Downloading databases	36	37.1
Usenet newsgroups	16	16.5
Reading weblogs	11	11.3

The number of hours spent at work on the internet is negatively related to the age of respondents (Pearson R = −0.464, $p < 0.001$) as we can see in Table 5: younger journalists tend to use the internet much more than older professionals.

One of the main aims of this survey was to understand if the internet has changed the sources of European science journalists. Literature produced some time before the dissemination of the internet states that science journalists live too close to their sources, tend to hunt in packs and depend too much on press releases from scientific journals. Had the internet changed this pattern?

To answer this question, we asked the respondents three different questions. The first question, about the favourite news sites, was completely open: respondents were confronted with blank spaces they had to fill with their choices. In this process, 264 blank spaces were filled, by 88 different subjects. The main sites for science news identified by European science journalists and the number of times they were cited are on Table 6. (This table does not show sites that were cited only once or twice.)

Older journalists show more diversity when asked about their favourite sites for science news: 21.1 percent of veteran journalists (more than 20 years on the job) do not

Table 5. Time spent on the internet daily by age group

	Time spent on the internet daily			
	< 3 hours	3–4 hours	> 4 hours	*N*
25–34 years	7 (18.4)	4 (12.5)	15 (62.5)	26
35–44 years	9 (23.7)	12 (37.5)	6 (25)	27
45–54 years	13 (34.2)	10 (31.3)	3 (12.5)	26
55–64 years	9 (23.7)	6 (18.7)	–	15
Total	**38**	**32**	**24**	**94**

Note: percentages in brackets.

Table 6. Favourite sites for science news

	Frequency	Percent
Eurekalert!	41	46.6
Nature	34	38.6
BBC News	34	38.6
New Scientist	25	28.4
Science	21	23.9
AlphaGalileo	12	13.6
NASA	9	10.2
The *New York Times*	5	5.7
Cordis	4	4.5
ESA	4	4.5
CNN	3	3.4
Total	**192**	**72.7**

Table 7. Mention of the three first sites (Eurekalert!, Nature, BBC) according to number of years as journalists

	Number of years as journalists			
	0–5 years	6–19 years	> 20 years	Total
None	1 (7.1)	2 (5.7)	8 (21.1)	11
One site	8 (57.1)	15 (42.9)	21 (55.2)	44
Two sites	5 (35.7)	16 (45.7)	9 (23.7)	30
Three sites	–	2 (5.7)	–	2
Total	**14**	**35**	**38**	**87**

Note: percentages in brackets.

mention any of the three top sites for science news identified in Table 6, as we can see in Table 7 (Spearman's rho = −0.173, $p = 0.05$).

The last question involving sources was aimed at evaluating the credibility European science journalists attribute to different online sources. Respondents were confronted with 12 types of organizations or websites they had to classify using a seven-point credibility scale, from 1 (not credible) to 7 (highly credible). Results for this question can be seen in Table 8.

In the last questions of this survey, respondents were asked to classify several statements in a seven-point Likert agree-disagree scale, in order to evaluate the consequences of the use of the internet for science journalism. Results for the three first statements can be verified in Figures 1 to 3.

In what concerns the quality of science journalism, respondents have no doubts that the internet has made the job of reporting science easier and better. Not so unanimous were the answers about the consequences of the internet on reporting practices. Figures 4 to 6 show the results for these questions.

Table 8. Credibility of news sources online

	N	Minimum	Maximum	Mean	Std. Deviation
Science journals' websites	96	2	7	5.92	1.083
University websites	96	2	7	5.71	0.917
International organizations	96	1	7	5.24	1.254
Big news organizations	95	2	7	4.91	1.082
Government websites	95	1	7	4.24	1.397
General interest portals	94	1	6	3.59	1.273
Industry websites	95	1	6	3.11	1.162
Political organizations	96	1	7	3.04	1.313
Corporate websites	94	1	6	2.98	1.182
Usenet newsgroups	90	1	5	2.82	1.097
Activists' websites	96	1	7	2.77	1.294
Chats and message boards	92	1	4	1.71	0.778

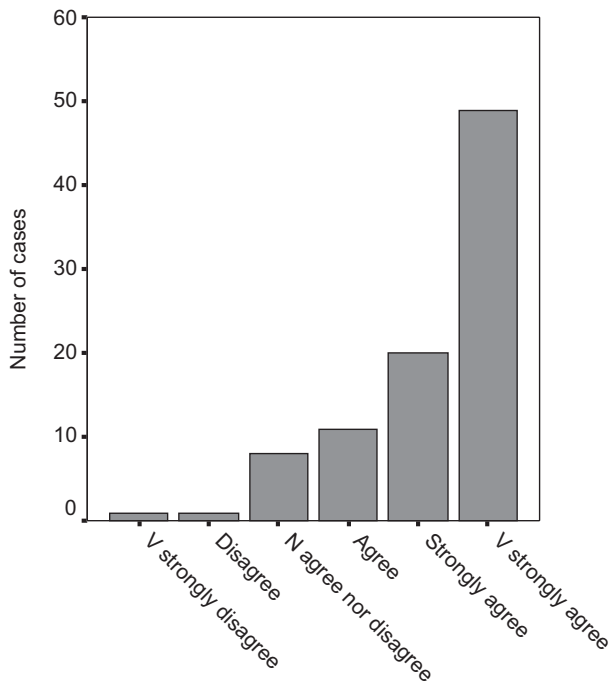

Figure 1. 'The internet has made my job easier'

There is a correlation between the GNI per capita and the answers to this last question: journalists from more developed countries think the internet is making science journalism focus more on breaking news, as we can see in Table 9 (Pearson R = −0.205, $p = 0.026$).

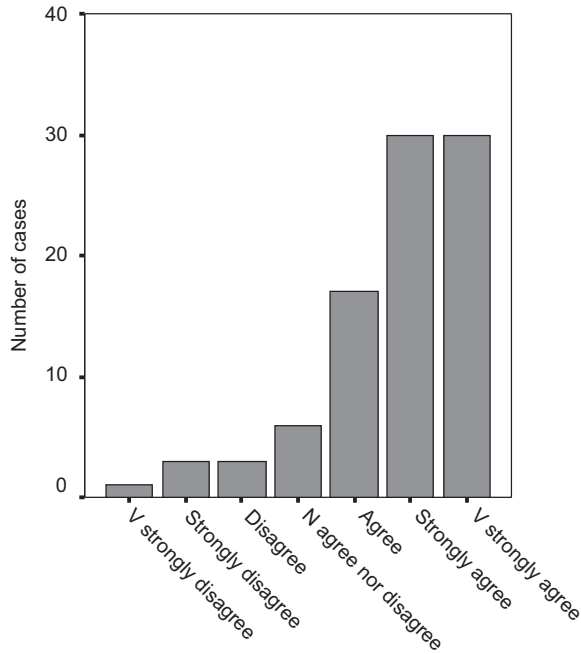

Figure 2. 'The internet has improved the quality of my job'

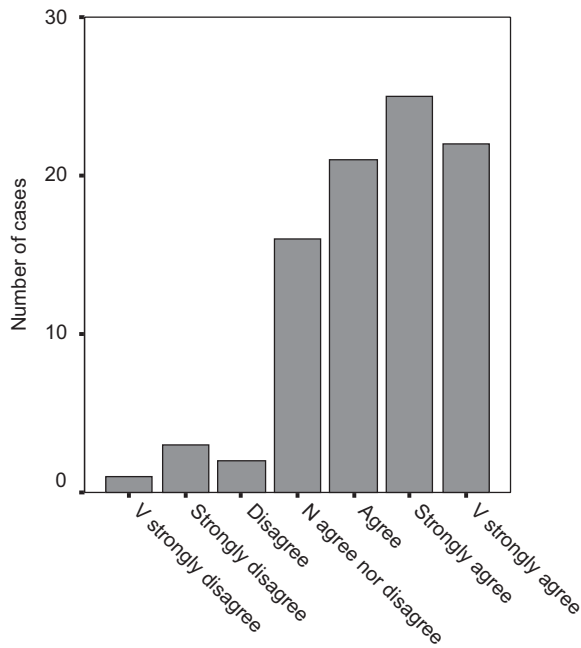

Figure 3. 'The internet has improved science journalism in general'

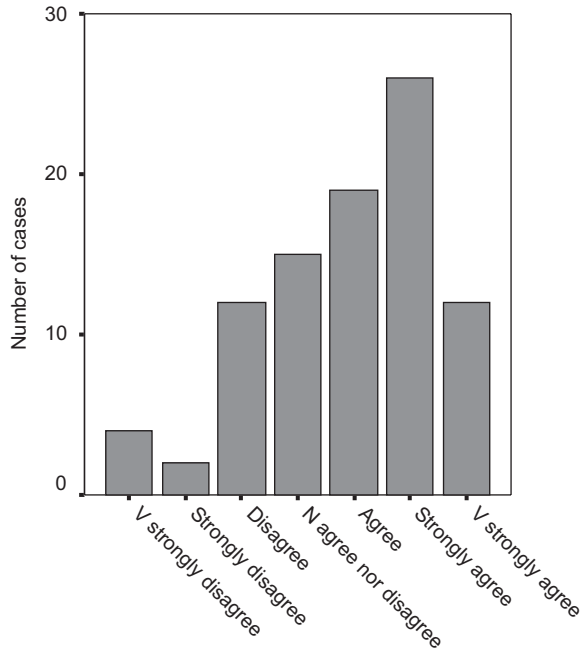

Figure 4. 'The internet is making science news more diverse'

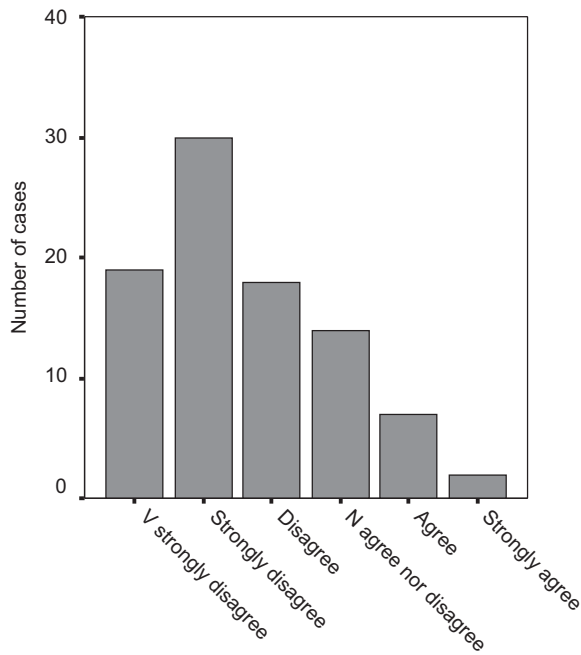

Figure 5. 'The internet is making journalists go out of the newsroom more'

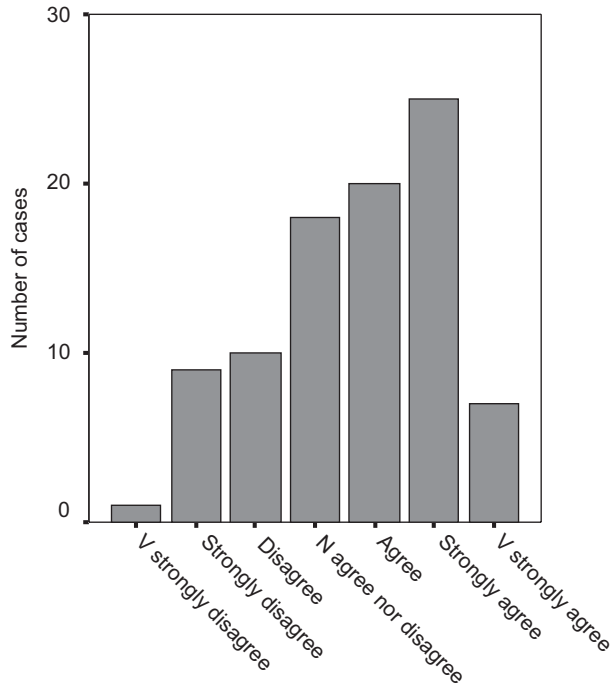

Figure 6. 'The internet is making science journalism focus on breaking news'

Table 9. 'The internet is making science journalism focus on breaking news' according to GNI per capita

	GNI per capita			
	< 22,000 USD	22,000–28,000 USD	> 28,000 USD	**Total**
Disagree / Strongly disagree / Very strongly disagree	4 (20)	6 (14.3)	10 (35.7)	**20**
Neither agree nor disagree	3 (15)	9 (21.4)	6 (21.4)	**18**
Agree / Strongly agree / Very strongly agree	13 (65)	27 (64.3)	12 (42.9)	**52**
Total	**20**	**42**	**28**	**90**

Note: percentages in brackets.

Results of the interviews

Science journalists interviewed stated they were using the internet quite often, mainly because it is an easy and very fast source of information.

> I use [it] actually everyday. It is essential for my work. One of the advantages is that it is a quick way of getting to know what is going on in the scientific world. (Interview 6)

At the same time, science journalists see the internet as a good way to contact sources who would be very difficult to reach just a few years ago.

> One important advantage is that if I want to get into contact with someone in Finland, or even in the United States or India, it is very easy through the internet. (…) I go to the internet and I can find the contact information quite easily and send an email. (Interview 8)

From the interviews conducted with these journalists, the dependency of these professionals on peer-reviewed scientific journals is more evident. In all the interviews, even without being asked directly about them, journalists talk about peer-reviewed journals and how the internet has made them more available. For example:

> All the articles of all the journals we need are on the internet, all the researchers. You can find the names of researchers who work in articles that you are writing about. (Interview 5)

> You can read journals or papers and find a lot of reports that were almost impossible before. (Interview 12)

In the survey, we had already asked European science journalists what were their main sources of information on the web. In the interviews, some of these sites were mentioned again by journalists, while answering very diverse questions, as an example of what they do on a daily basis.

> I follow certain pages: for instance, the BBC, some Finnish pages, *New Scientist*, so you get a good picture of what is going. (Interview 6)

> You must remember that those big journals, like *Science*, *Nature*, *The Lancet*, whatever, have self-interest. (Interview 3)

In their interviews with American science journalists, Dumlao and Duke (2003) came to the conclusion that email and the web were 'speeding' information, 'in ways that were benefiting their work and the dissemination of information'. From our own interviews, we could understand that European science journalists see the fast access to information as essential to their daily routines. In response to the question 'What are the main advantages of the internet in your work as a science journalist?', interviewee 4 simply answered: 'Certainly the speed. And the amount of information you get.'

Some of the interviewees also mentioned fact-checking as an important task that could be more easily done with the internet.

> The latest figures are always up to date and it is very easy to get them while you are writing an article. (Interview 1)

> You can very easily collect information. And then you can check from different sources if the information is correct. (Interview 6)

The amount of information the internet has brought into newsrooms has also some disadvantages, as some of the interviewees have pointed out. The main problem European

science journalists identify while dealing with the web is the credibility of the information they find, not always evident after making a query on Google.

> I don't really know if the information is reliable and sometimes you can find so many interesting sites that you just don't know where to begin. (Interview 1)

> The biggest drawback [of the internet] is often the lack of ways of verifying the quality of this information. (Interview 2)

Some years ago, science journalists were receiving stories from personal contacts and news agencies, through normal mail and faxes. Nowadays, the quantity of information on the internet is overwhelming. And that is a problem:

> [The internet] has given us more time pressures. If you work in a daily paper, it's the time pressure and it's too much information. Every day you get information about, I don't know, 1500 reports that you can write something about. You have to read it and decide what to do about it. It is too much. (Interview 3)

Dumlao and Duke (2003) came to the same conclusions while interviewing American science journalists: there is an excess of information on the web and science journalists spend too much time dealing with it. At the same time, some of the interviewees of that research project also complained about the increased time pressure the internet has brought into newsrooms.

The internet is affecting science journalism all over European newsrooms, as science journalists feel more pressure to keep up with the loads of information coming from the web every hour of the day. First of all, European science journalists feel that the internet is now part of their daily routines and they use it so often they almost forget about it:

> It has made our work easier and more comfortable, especially because you can get information very quickly. (Interview 6)

> It is a normal thing now. You have a name and you want to know more about the curriculum of that person, you find it on the internet. You have an article, you can search it on the internet. You want to know more about a university, or a department, or a lab, you can find it on the internet. It is a common instrument now. (Interview 5)

Science journalists acknowledge this dependency on the internet and cannot imagine themselves working without it:

> I don't think I could work without the internet, because a lot of the latest news is distributed through the internet. If you wait until you have a paper, a real concrete paper on your desk then you are much too late. Because of the speed, you can't do it any more. (Interview 1)

> Because 99 percent of the communication of science is made through the internet or email, you cannot avoid it. It is not possible to do science journalism without it any more. (Interview 4)

> For me, it would be more or less impossible to work without it. I have some contacts, but for every new subject I have to find out contacts, and without the internet that would be impossible. (Interview 6)

> Nowadays it is impossible to work without [the] internet. (Interview 11)

Some journalists are not so radical, but they admit it would be much more difficult to work without access to the internet:

> It would be very hard [to work without the internet]. To check for information, for instance. (Interview 3)

> It might be possible, if we worked in a specialized magazine, like *New Scientist*, because they have many, many journalists working there. They have good contacts all over the world, they have their phone number and everything. I am working more or less alone. (Interview 6)

European science journalists are also aware of the problems the internet brings to science journalism in general. The focus on more international science is clear for these professionals. At the same time, European science journalists admit they are relying more on information coming from scientific journals and that this is one of the most important changes the internet introduced in their routines.

> Our job is more focused now on the big scientific journals … the embargo system. It is more evidence-based than it was before, because of this peer-reviewed system. (Interview 10)

> I now write more about the journals. (Interview 8)

Because of the pressure they feel from management, and also because of the lack of resources, European science journalists are not leaving their desks to visit laboratories or go to conferences. And they see it as a direct consequence of the internet:

> You get stuck to the reports you get on the internet. I sit down and I can take three or four hours to read all the reports and to decide what to do about them. I could have done other things if I wasn't doing that … (Interview 3)

> You are stuck in the office. (…) Instead of going out, meeting scientists, go to conferences and see the reality. (Interview 7)

Isolation from 'reality' seems to bother some of the interviewees for this project. 'Reality' means, for this purpose, the laboratories and conferences where journalists can normally find scientists doing their work. Instead of visiting those places, journalists feel prisoners of their newsrooms.

Conclusion

The internet is profoundly changing the daily routines of European science journalists working for the main daily newspapers and news agencies in this continent. From the

dataset collected, which represents a snapshot taken at a particular time in the adoption of the internet by science journalists, it is fair to say that the web is even changing science journalism itself. Journalists are depending more and more on information subsidies originating in peer-reviewed scientific journals, and declare spending most of their time inside newsrooms navigating the internet looking for the latest reports.

Before the internet, journalists working for national outlets were already spending a lot of time inside newsrooms, mainly because deadlines became more crowded as a result of competition with TV, and urban traffic got worse and worse. At that time, most of the reporting was being done by phone (Glaser, 2003). With the arrival of the internet, newsgathering without leaving the newsroom became easier: Science journalists were in the frontline of adoption of this new technology and were captivated by its potential. Now, from what they expressed during the interviews, they feel 'stuck' to their newsrooms, they are working under increased pressure and they keep writing about what other science journalists write about, as we have seen from the results of the survey and the interviews.

In science journalism, the adoption of the internet as a reporting tool seems to have happened faster than in other beats (Trumbo et al., 2001). Scientists, the main sources of science journalists, were already using the web when it became publicly available, and journalists saw this new technology as an excellent way to contact them, get more information, and reach previously unavailable documents. We know that these journalists, at the time of the interviews, were spending an average of 3.5 hours on the internet while at work and that 62.5 percent of the younger science journalists (25–34 years old) said that they are on the web for more than four hours per day.

Because of the concentration of science journalists in a few websites, we can hypothesize that traditional science journalism is now less diverse than it was a few years ago. Extensive content analysis has to be conducted to confirm this assertion, but it is only fair to presume that the main daily newspapers and news agencies in the European Union are writing about the same issues, because we know they are following the same stories and contacting the same sources no matter which country they are in, as the survey has shown. *The State of News Media 2006*, a report published in the United States by the Project for Excellence in Journalism, based on the analysis of the news produced in one single day in the United States, comes to a very similar conclusion: 'The new paradox of journalism is more outlets covering fewer stories' (Project for Excellence in Journalism, 2006). The authors say this repetition of stories happens across all beats:

> While the news is always on, there is a constant flow of new events. The level of repetition in the 24-hour news cycle is one of the most striking features one finds in examining one day of news. Google News, for instance, offers consumers access to some 14,000 stories from its front page, yet on this day they were actually accounts of the same 24 news events. (Project for Excellence in Journalism, 2006)

A more recent report, written in the United Kingdom, comes to the same conclusion:

> A major consequence of increasingly resource-strapped newsrooms is that specialist reporters complain that they are expected to rely too much on 'dairy stories', and are not given enough time for independent journalistic work. (…) This urge to 'keep up with the Joneses' results in a

> self-perpetuating reliance on predictable news agency – and PR – led news (so-called 'low hanging fruit') which discourages 'original journalism'. (Williams and Clifford, 2009: 4)

This new paradox of journalism, that is, the loss of infodiversity in news, needs to be studied more deeply. Small pieces of evidence, coming from different places, are all contributing to solidify the idea that science journalists are writing more and more about the same stories, as they are visiting and using the same sources. And this situation is probably one of the most important consequences of the introduction of the internet in newsrooms and of the increased workload of science journalists.

Once thought to be an opportunity to pay attention to multiple voices across the world, the web is helping to homogenize news in different countries. The pressures to follow big media that are considered to be an example for the industry are now more intense, especially in countries with a lower GNI per capita, as we have seen in the results of the survey.

The use of the internet for newsgathering is also linked to the age of journalists. Younger science journalists show a heavier use of this technology in their daily routines. As a consequence of this situation, one can expect that infodiversity in science news will diminish in the future, when most experienced journalists retire, and give way to a new generation of professionals who always lived with the internet. In a study of local television health journalists in the United States, Andrea Tanner concludes that journalists are learning of story ideas through a 'passive news discovery process in which reporters find story ideas without ever leaving the newsroom' (2004). Williams and Clifford (2009) say that 'there is a general sense that PR has become an increasingly important and unavoidable presence over the last decade'. From what we have learned from this survey, European science journalists are following this pattern and accepting it as normal.

The results of this project are even more interesting if we take into account the surveyed population: highly educated, very experienced professionals, working in larger than average science sections at very important news organizations in the European Union. These media, national newspapers and national news agencies, whose journalists were surveyed and interviewed for this project, are widely read inside their respective countries (some even abroad) and are certainly influencing what gets reported in other media.

This situation means that the communication of science by the media inside the European Union is dominated by articles about the research published in peer-reviewed journals, most of them about American science. At the same time, many of these newspapers and news agencies are seldom talking about what European researchers are doing on a daily basis, or about the science being done inside the laboratories. A recent report by the European Commission (*White Paper on a European Communication Policy*) says that 'media coverage of European issues remains limited' (Commission of the European Communities, 2006: 9). In what concerns science news, this observation closely aligns with the conclusions of this research.

It is also clear that readers are receiving a distorted image of science, as some authors have pointed out years ago (Goodell, 1977, for instance). If science journalists are staying inside their newsrooms and are not visiting laboratories and conferences, readers can only make contact with the final product of science: the published scientific article. The whole practice of science is being forgotten and journalists become passive transmitters of information coming from organized sources, as they admitted at the time of the interviews.

From this point of view, we can say that publishing companies were successful in setting the agenda for science. Every week, in every country, science stories coming from scientific journals appear at exactly the same time, often citing the same sources. The internet has amplified this cooperation by bringing journalists closer to scientists. The public understanding of science movement has encouraged scientists to use public relations techniques to communicate with the population, in order to push the science agenda. The collaboration between science journalists and their sources has given more control to scientists.

> Collaborating with journalists and adapting to journalistic conventions may give scientists more, rather than less, control over the emphasis and tone of the resulting story. (Gregory and Miller, 1998: 131)

From the data collected during the survey and the interviews, it became clear that, although science journalists still do some of their reporting outside the newsrooms, they now spend much time inside. Eric Meyer, associate professor of Journalism at the University of Illinois, has a good description of what the internet represents inside newsrooms:

> The Internet is the perfect chain-paper journalistic gimmick. In the wrong hands, it's cheap, fast and predictable. Instead of enabling greatness, it enables journalistic lethargy. But that's human nature. (Glaser, 2003)

'Cheap' and 'fast' were certainly two of the characteristics that helped science journalists, in Europe and all over the world, to adopt the internet as one of their most important tools for newsgathering. Some of the interviewees pointed to them as advantages for using the web, but they were also aware that lethargy is also playing a part in this process:

> We're used to it and we have grown lazy. It is possible to work without the internet, but it would be much more difficult nowadays. We would lose the instantaneity that the internet brings. We could go back to snail mail or phone interviews, but it wouldn't be the same. (Interview 2)

Notes

1 At that time, the European Union was formed by only 15 countries.
2 http://www.eusja.org/
3 The first invitations to participate in this survey were sent by mail on 17 November 2003 to all 208 journalists, in a cover letter with the logo of the University of Leeds. The letter included a unique link to the survey website, so that journalists could go there and answer all the questions. Nineteen journalists answered the survey before being sent the first email. The first reminder was sent by email on 2 December 2003. At that particular time, 23 emails bounced back, which means they were not received by the respondents. The main reason for the rejection of the messages was the non-existence of the specific email address, either because it was wrong or the journalists had already left the newspaper/magazine/news agency. Subsequent reminders were sent on 7 January 2004 and 27 January 2004, with 21 and 20 rejections respectively.

4 The percentage of respondents takes into account every journalist who was invited to participate in the survey. If we were to eliminate the 23 journalists who only received the letter, because the emails bounced back, and the three journalists whose email was impossible to get, the percentage of respondents would have risen to 53.3 percent ($N = 97/182$).
5 World Bank (2005) *World Development Indicators*, 2004. Washington, DC: World Bank.
6 From now on, the expression 'European science journalists' will be used to characterize the surveyed population. It is not absolutely correct – it should be 'European science journalists working on staff for general print media and news agencies in 14 countries of the European Union' – but it is certainly shorter and avoids very long and awkward sentences.
7 $t(94) = 1.1805$, $p > 0.05$
8 $F(2, 93) = 9.128$, $p < 0.001$
9 $t(94) = 1.951$, $p = 0.05$
10 $F(2, 93) = 4.893$, $p = 0.01$
11 $t(94) = 2.005$, $p = 0.048$
12 $F(2, 93) = 2.518$, $p = 0.086$

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