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Challenges and opportunities for science journalists in adopting new technologies: the case of Spain

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ABSTRACT: This paper analyses the adoption of new information and communication technologies (ICTs) by Spanish journalists specialising in science. Applying an ethnographic research model, this study was based on a wide sample of professionals, aiming to evaluate the extent by which science journalists have adopted the new media and changed the way they use information sources. In addition, interviewees were asked whether in their opinion the Web 2.0 has had an impact on the quality of the news. The integration of formats certainly implies a few issues for today's newsrooms. Finally, with the purpose of improving the practice of science information dissemination, the authors put forward a few proposals, namely: Increasing the training of Spanish science journalists in the field of new technologies; Emphasising the accuracy of the information and the validation of sources; Rethinking the mandates and the tasks of information professionals.

1. Introduction and objectives

The media and journalists are fundamental players in the process of science dissemination. The public opinion on new scientific developments is basically formed through articles on newspapers, TV programmes and information heard on the radio. However, for the past decade or so, the emergence of the Internet as an informative platform has added to the traditional media mentioned above, and has turned into a key element in the spreading of innovation. New technologies have reached the heart of science popularisation, and journalists have had to adapt to this new reality very quickly. Thanks to the Internet, users have become active players and this tendency has become more evident with the evolution towards the Web 2.0, i.e. towards platforms promoting the collaborative production of content,[1] up to the point that now the reader can be an information populariser at the same time.

The changes brought about by the new social networks raise many questions about how the old media and professionals in the field have relocated. The change to a more "conversational"[2] model of journalism requires journalists to reconsider the routines and the role that have characterised their job up to now. For example, a study carried out in Sweden by Hedman and Djerf-Pierre[3] on journalists working in different media has highlighted that the penetration of new technologies and social networks is high among the information professionals; however, such instruments keep on being used to

perform traditional tasks such as looking for, receiving and spreading information rather than to create virtual networks among professionals or to interact with readers. Other academic works have specifically investigated these changes through the professional routines of science journalism: Amend and Secko,[4] Bauer et al.,[5] and Williams and Clifford.[6] The two former authors specifically studied the impact of new technologies on scientific journalism in the United Kingdom and concluded that the Internet is an essential instrument for work, but the need to be constantly connected has caused the time to write on scientific subjects to be dramatically reduced. Another noteworthy study by Colson[7] in Belgium and France highlighted that the emergence of the Web 2.0 has allowed scientists and journalists to become more proactive. The study demonstrates that blogs increase scientists' reach to the public. In return, it demonstrates that the articles by journalists do not sufficiently use as a source the information appearing on researchers' blogs.

The authors of this paper wondered whether all of this has had an impact on Spain, and therefore they intended to take a detailed picture of Spanish science information professionals and their adaptation to the new media.

In this research[8] we set the following objectives: a) Establishing to what extent Spanish journalists have adopted new technologies, and the Web 2.0 in particular; b) Discovering the advantages and the drawbacks generated by new technologies in the routine of science journalists; c) Identifying the changes that have occurred in the interaction of journalists and the media with their audience.

In order to develop this research, the following questions were formulated:

Q1. What influence has the impact of new information and communication technologies (ICTs) had on the professional practice of science journalists?

Q2. To what degree has the Web 2.0 affected the quality of information as perceived by the science professionals of the Spanish media?

Q3. Do science journalists use the information that appears on the Internet and the social networks as a source of information?

The answers to the questions formulated followed a methodology based on qualitative criteria. The data are based on 49 in-depth interviews, 49 questionnaires and 2 focus groups with science journalists working in Spain. The sample [N=49] is highly representative of the category, given that in Spain the number of science journalists is estimated to be around 150 in total. Consequently, this can be considered as a stratified sample of about one-third of all professionals in the field.

2. Theoretical framework and previous research

This research is based on two theoretical principles. Firstly, it aims to emphasise previous research projects having journalism and science communication as a theoretical framework, two fields in which vast in-depth research has been carried out. Secondly, this paper deals in theoretical terms with disciplines studying new information and communication technologies (ICTs). In this regard, the paper also

approaches the theoretical currents that analyse the adoption of the new media in the information environment, specifically journalism.

In a science communication perspective, it is to be noted that ethnographic research has focused on various aspects. Many papers have analysed the precision of science coverage in the media[9,10,11] or the satisfaction of the scientists on the way journalists report their work.[12] Also, they have revealed serious shortcomings, including the fact that science journalists tend to report uncritically,[13] to fall into sensationalism and create false expectations,[14] to not present opinions from the experts,[15,16] or to prefer optimistic messages when selecting and processing information.[17]

Previous research has revealed the profile of science journalists as a group that heavily relies on science personnel, i.e. on scientists.[18] In addition, it has been shown that science journalists are wary of industrial companies, especially pharmaceutical companies, which are advertised by press agents.[19]

Many authors have studied a series of ethical obligations of science journalists to the public[20] and to the people working in science.[21]

The need to choose the best sources to compare the information was analysed by Conrad,[22] whereas the lack of a critical approach to published science information was investigated by Hijmans.[23] Some of those shortcomings are due to a lack of time to carry out the work,[24] a specific academic education, or to a distortion of the information based on a series of psycho-social factors, such as the perception of the audience or the editorial line of the medium.[25]

An excellent starting point for a brief overview of how professional routines in science journalism have been investigated starting from the opinions of the collective of science journalists can be found in the abovementioned studies by Amend and Secko and Williams and Clifford.

Amend and Secko[26] propose a meta-synthesis based on the analysis of the ethnographic research carried out in various countries on the experiences of science journalists. Surveys, structured interviews and/or focus groups were the techniques used in the majority of the research projects. The paper concludes that the issues dealt with by most of the studies are divided into: 1) main issues: the relation of the journalist with the sources and the selection criteria of the news; 2) common issues: journalism practices and instruments, the limitations of the journalistic work, the audience, the education of journalists, the scientific knowledge of journalists, the role of journalists, the difference between specialised and generalist journalism; and 3) minor issues: the medium format, the effect of the use of different languages in a bilingual community, the conflicts of interest and the presence, or not, of a methodology in journalistic texts.

The conclusions drawn from this meta-synthesis are the following: (1) the appeal that the authors make to science journalist to move from the description of data to the interpretation of such data, with the desire to break the state of dependence on the scientific sector sources; (2) journalists are very jealous of their work, and aside from gathering information allowing them to develop their work and dispel their doubts, they do not want any interference from science professionals in their work. They are reluctant to cooperate in drafting or correcting their news items. Those two aspects

show a contradiction: on the one hand, science journalist partly depend on the scientific field for information and reporting, but in turn science journalists do not leave room to anything but receiving the information. These studies demonstrate that a more fruitful attitude would be one of mutual collaboration, and to that purpose a better education of science journalist on scientific subjects would be required, as well as a better collaboration, in which the two groups of stakeholders would have to engage in a more proactive way.

Williams and Clifford[27] studied the professional practices starting from ethnographic techniques based on science journalism routines in the United Kingdom. Williams and Clifford,[28] with a wide sample of journalists (N=47), focused on the following issues concerning this profession: (1) the relation of science journalists with sources; (2) the relation of journalists with the editors-in-chief of their news organisations; (3) the precarious situation of the profession and the crisis of the modern journalism model; (4) the impact of new technologies on science journalism.

With regard to those issues, the main conclusions of the research — some of which are very similar to what was said above — are: (1) the relation between sources and journalists is asymmetrical, as scientists are too influential in the decisions made by journalists, since the latter rely heavily on them; (2) there is a good relation between science journalists and their editors-in chief, as — differently from the past — they do not need to engage in a constant battle in order to convince them to publish science-related articles; (3) there are less jobs available in newsrooms, but they are require a higher degree of specialisation; (4) the workload of science journalists has considerably increased after becoming a member of the staff of a newsroom; and (5) the Internet is an essential instrument for work, but the need to be constantly online has caused the time to prepare scientific articles to be dramatically reduced. Finally, another recent ethnographic study carried out by Bauer et al.,[29] involving approximately one thousand science journalists worldwide, explored how the decline of the traditional journalism model has affected science journalism. Still on this topic, Brumfiel,[30] in his turn, focused on how science journalists perceive this decline of their traditional business model and what the alternative models on the horizon could be.

As noted at the beginning of this section, it is necessary to emphasise the theoretical references that come from the field of the information and communication technologies (ICTs) that add to the ones already mentioned for the field of science journalism. The analysis of the adoption of the new media in the news environment requires a few preliminary observations.

Firstly, the history of the media shows that any new medium — in order to be understood and included in the consumption habits of users — has to rely on the media that came first, changing it in a more or less original way, but always making a few references to the past. Marshall McLuhan already observed that the old media end up being the content of the new media: “the content of any medium is always another medium. The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph.”[31] More recently, Bolter and Grusin[32] have dubbed this phenomenon ‘remediation’: if cinema remediated photography and

television remediated radio and cinema, today the Internet remediates television, telephone, radio and the other media.

Secondly, in order to fully appreciate online communication it is necessary to approach it not only in terms of technical characteristics and content. As the new media is catalyst of technological, social, political and economic factors, one should consider the devices used to communicate as well as the practices in which people engage to share information and the social structures that develop around those devices and practices. In the new technological environment these three components intertwine to the point that it is no longer possible to think of any of them singularly. According to Castells,[33] in an information-oriented society, technological determinism is a false problem because technology is society: although technology itself does not determine the historical or social evolution, it does represent the ability of society to change. Today, deep structural changes are developing starting from the advances in information processing and communication technologies. Thanks to their ubiquity, the Internet and the digital media are able to enter real life and remodel it according to the metaphor of the network, which is a set of points united by connections always of a different kind. The result is the creation of a network of networks or, to put it better, the network society. In this new structure, the perception of space and time changes completely, and space as the "material support of time-sharing social practices"[34] disappears and is replaced by a space of flows as the "material organisation of time-sharing social practices that work through flows."[35] In other words, the new media allow interactions to take place irrespective of the physical space in which the social players may be in. Digital technologies do nothing but emphasise that sense of space-time compression that Harvey[36] already pointed as typical of the post-modern condition, characterised by the shift from the Fordist economic model of division of labour and mass production to one based on flexibility and symbolic elaboration as a productive force.

The transformation of the technological and social environment alters the communication models and practices in different aspects. In terms of content and presentation, the Internet appears as the most modern version of the syncretic texts described by Greimas and Courtés[37] as a "plurality of languages of expression" organised in a single communication system. Similarly, the web is characterised by the coexistence of varied semiotic systems that involve different signifiers but end up being consistently cohesive within a unified communication strategy.

As to communication processes, as opposed to the traditional one-to-many pattern, the ubiquity of the digital media enables any individual or group to spread messages according to a many-to-many model that ignores the limits of space and time. In the network society, the distinction between the sender and the emissary of a message becomes blurred and a new model of user emerges: the *prosumer* or proactive user. New technologies increase the opportunities for participation in the public arena and favour "the movement of some intelligence, from the transmitter to the receiver."[38] The increase in the potential transmitters also changes the old power balances: institutions of any type, which previously benefited from the control over the information flows are forced to evolve towards an accountability model.[39] As the theorist of virtual

communities Howard Rheingold noted, the passive dumb mobs of mass society are evolving into smart mobs of active individuals who "cooperate in ways never before possible because they carry devices that possess both communication and computing capacities."[40]

The active role of users has gained centrality with the evolution to the Web 2.0, a term used to refer to those web pages (social networks, blogs and wikis, among the others) that promote the collaborative production of content. This concept started to become popular in 2004 when Tim O'Reilly, during a conference, first spoke of the architecture of participation as a discriminating factor in this new web model. In the 1.0 era users only were passive observers of content that others had created, in the 2.0 era web pages become platforms for the distribution of content generated by the users themselves, which substantially are in a "perpetual beta"[41] condition as they can be modified by the community of peers. Thanks to the collaborative character of the 2.0 architecture, users can experiment a richer fruition, beyond "surfing" and beyond the media and, on the other hand, can enrich public debate with their contribution. The processes illustrated have a profound impact on journalistic practices inside and outside the newsroom. As to production routines, one of the most obvious effects of technological convergence is the dissemination of hypertext news suitable for a multiplatform access. On the one hand, this trend multiplies the opportunities to access information; on the other hand, it requires journalists to develop new skills to adapt to the new multimedia context, not only as a broadcasting instrument, but also as a working environment. In addition, the pervasiveness of the new media alters the traditional production and life cycle of the news, intensifying the perception of the perishable nature of the old media: according to Ignacio Ramonet[42] "the emergence of the Internet increases the feeling of chaos, because it definitely establishes real time, the instant moment, as the normal pace of information."

If the convergence and the ubiquity of the digital media substantially act as watersheds in the journalistic practice, they do so also outside the newsrooms. As Jenkins notes, "if the activity of media consumers was once silent and invisible, they are now noisy and public."[43] First, online information does not imply a single reference audience but a myriad of new audiences with different consumption habits and preferences in terms of content. With the increase in the volume of the news spread on the Internet, users react through personalisation mechanisms that enable them to choose what news to receive, how and when. The consumer's proactivity also affects the relationship with journalists, who are forced to rethink their role in this new decentralised structure. However, a study conducted in six European countries (Belgium, Finland, France, Germany, Spain and United Kingdom) and the U.S. on the online versions of the old media has highlighted a certain resistance of the media towards the active role of the audience.[44] A user is only allowed to intervene on the content provided by the medium itself; instruments that invite users to submit material or proposals are rarely offered. As to the social impact of the evolution of journalism, the Internet and especially the Web 2.0, as mentioned above, offer new opportunities for participation such as emails, comments or chats. A proactive process that occurs especially when there are emergencies and various types of crisis.[45] Although not direct

evidence of improvement in the quality of public debate, the presence of different access channels provides a chance to create arenas in which the different points of view of social stakeholders are more effectively and openly represented than in the pre-existing media.[46] However, in order to ensure a genuine plurality of voices, one should avoid falling into the temptation of attaching to ICTs the intrinsic ability to stimulate user interaction and proactivity. Without entering the debate on technology neutrality, one should remember that the web is an area of conflict "because it is a privileged tool for acting, informing, recruiting, organising, dominating and counter-dominating."[47]

3. Methodology

The data used in this research were collected through 49 in-depth interviews, 49 questionnaires and 2 focus groups with science journalists working in Spain. The sample surveyed with the two first methods included 49 science journalists working under one of the following conditions: full-time journalist, part-time journalist or freelance journalist regularly collaborating with a news organisation.

The sample [N=49] is highly representative, as the total number of science journalists in Spain is estimated to be around 150, based on the answers given by the science journalists interviewed to the question "What is the total number of science journalists working for your news organisation, including yourself?", and then making the adjustments required. In selecting them, we made sure that the interviewees represent the main media companies in the country and the different types of media (newspapers, radio, television, the Internet and news agencies). Journalists working in press offices were not selected to be included in the sample.

The in-depth interviews, lasting about 60 minutes each, were carried out by five researchers in different Spanish cities, although the majority of them took place in Madrid and Barcelona. Once the data collection and processing was completed, it was calculated that the male gender was predominant (65%) and the interviewees had been working in the field for about 12.25 years on average.

On the other hand, all the science journalists — at the end of the interviews — had to answer to a standardised questionnaire including 54 questions to complement the answers of the in-depth interviews. In the majority of cases, the questions were presented according to a 5-level Likert Scale (1= totally agree; 5= totally disagree).

Finally, we have conducted two focus group sessions in Barcelona. Each session, led by a moderator and followed by two reporters, consisted of a group of science journalists comprising 12 to 15 people, as well as other experts on the issue.

The sessions lasted approximately 90 minutes. The focus groups as well as the in-depth interviews and the questionnaires were carried out in the period between May and September 2012 and were recorded and transcribed. The entire project was implemented by five researchers under the same criteria.

All the respondents were guaranteed anonymity and the confidentiality of the information provided. For this reason, in this paper the journalists are identified through numbers and not their real names. The expression (SJXX) means Science Journalist number X.

4. Results

The results of the research show that in general journalists think the influence of new technologies on their professional practices is positive (72%) or very positive (19%), especially for the opportunity to work online from home and to share documents. However, 9% of the sample think that the use of technology also implies negative consequences, especially owing to the lack of a global development plan of ICTs ("The training provided by companies is too poor for us to evolve" – SJ20). The lack of training courses generate an inclination to a feeling of "fear of the unknown" (SJ28) and, in a few cases, the introduction of the digital environment is perceived as problematic and even traumatic (according to 32% and 4% of the research sample, respectively).

Also the resources available appear as an important element in the evaluation of the employment of the new media, not only in terms of inequality between large and small companies, but also in terms of wasting internal resources ("they are looking for a 'philosopher's stone' allowing them to make an abrupt transition to the Internet" – SJ07). One of the challenges introduced by new technologies that has attracted the most conflicting reactions regards the management of time in relation to the news production cycles. As noted above, the digital media — unlike the broadcasting media — offers the opportunity to receive, seek and disseminate real-time news. On the one hand, this time compression involves some positive effects on professional practices. First, the reporter, thanks to the ICTs as a tool for information search, is no longer forced to "hit the streets": the reduction of the time spent on this activity has been quite evident to 44% of respondents, and very evident to 23%. As concerns the use of ICTs as a tool to disseminate information, 100% of the sample acknowledge the positive influence of technology on the ability to spread information, and 88% also appreciate the rapidity of digital media in performing this task (figure 1).

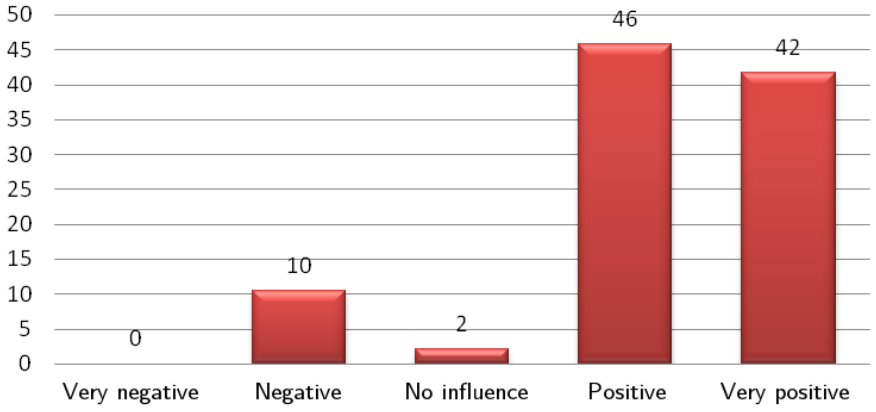

Figure 1. Perception of the influence technologies have on the ability to spread information quickly, percentages (calculation based on this research).

On the other hand, the time span in which news become old — i.e. stop being "breaking news" — is considerably shorter and shorter, and this generates in professionals the feeling that these days rapidity is too predominant in their work. The fear of the soundbite effect is one of the causes leading to 45% (figure 2) of them to believe that technologies have impacted negatively or very negatively on the time to research and produce news ("We are just left with the title — this happens ever more frequently — and that title requires many nuances" – SJ05). What emerges is also a certain level of uncertainty in deciding what content to publish, when and where: a few respondents said at times journalists themselves, by publishing news through a digital channel, end up hurting the medium they belong to.

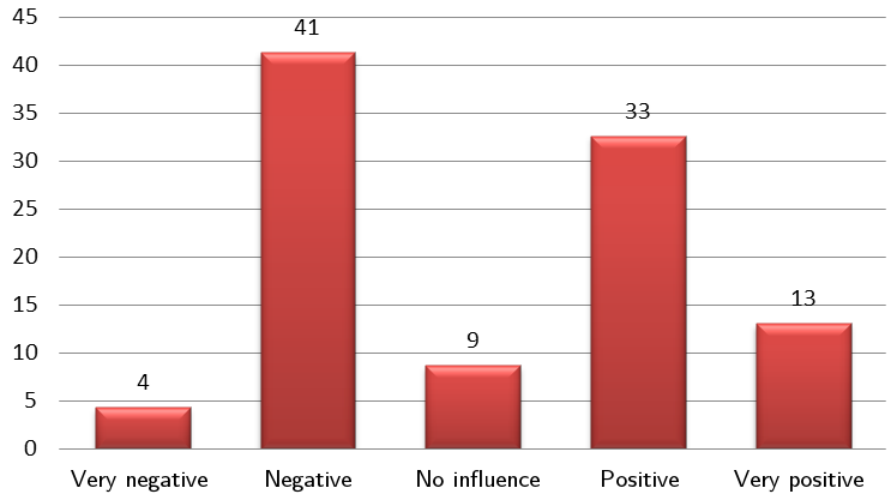

Figure 2. Perception of the influence technologies have on the time spent on researching and preparing news, percentages (calculation based on this research).

Another aspect that divides the respondents is the relationship between the new media and the veracity of the information (figure 3). Among them, 27% believe that ICTs have not had any effect, whereas 32% do believe in a positive increase. In this sense, many journalists point out that, thanks to its new large-scale diffusion, information can more easily reach the specialised audience and therefore the news can be disputed by expert users ("if you publish a piece of news that is a bit false, there now are thirty people responding to you" SJ06). However, a significant remaining 30% still distrust technologies from this point of view: "journalists can still spread misconstructions because they get information from people that do not dispute, nor confirm or verify anything" (SJ17).

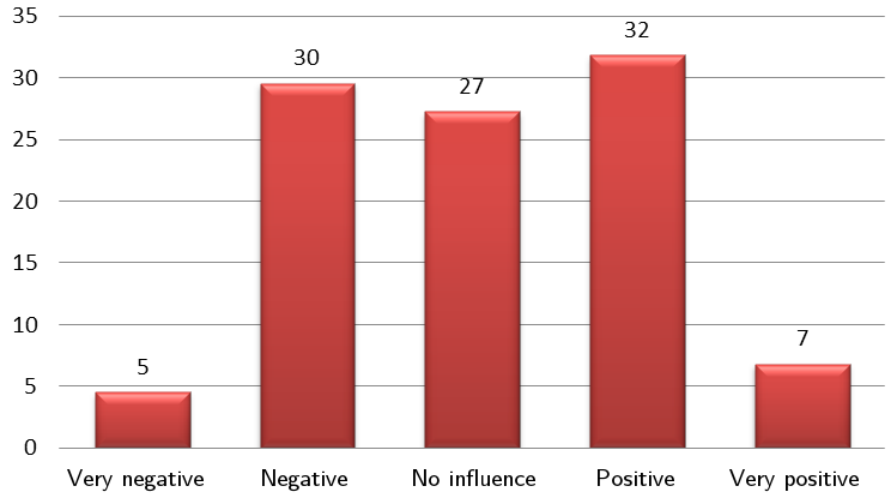

Figure 3. Perception of the influence technologies have on the veracity of information, percentage (calculation based on this research).

The issue of the veracity of information is often connected with the subject of the information sources of journalists. In the majority of cases, the interviewees have a positive (67%) and very positive (15%) opinion on the influence of the ICTs on their relation with sources, although some of them (10%) also acknowledge their negative aspects: the Internet represents "a chance to get directly to the source, although you can sometimes get lost in the way" (SJ46). A plurality of voices connected through the net implies the chance to quickly compare different sources, but sometimes it also represents a multiplicity of potential sources that involve obvious difficulties in filtering the reliable information that can be published as a piece of news. In this sense, a few respondents said they rely on science blogs as reference areas for consultation, especially those written by accredited researchers or institutions, provided they do not fall into the temptation to appear as a simple compilation of press releases. As to the relationship with official sources, journalists report an improvement in terms of accountability[48] at the level of institutions: whereas much information was previously inaccessible, the new media now generates more transparency and democratisation.

In the relationship with the sources, social networks also play an important role. Since their explosion in the mid-2000s, these platforms have been gaining users not only for personal enjoyment but also for professional use. The area of science journalism is no exception to this, and in fact 96% of respondents acknowledge the increasing or very high effectiveness of the social networks: their role is fundamental to 30% of the sample, significant to 34%, limited yet increasingly important to 32%, and negligible only in 4% of the cases. For the most part, journalists said they use social media to stay informed and documented: 2.0 platforms are used in newsrooms to supplement, or in some cases replace, consolidated professional practices like teletype messages, in order to maintain direct contact with the sources and to compare the news in real time (see figure 4 below).

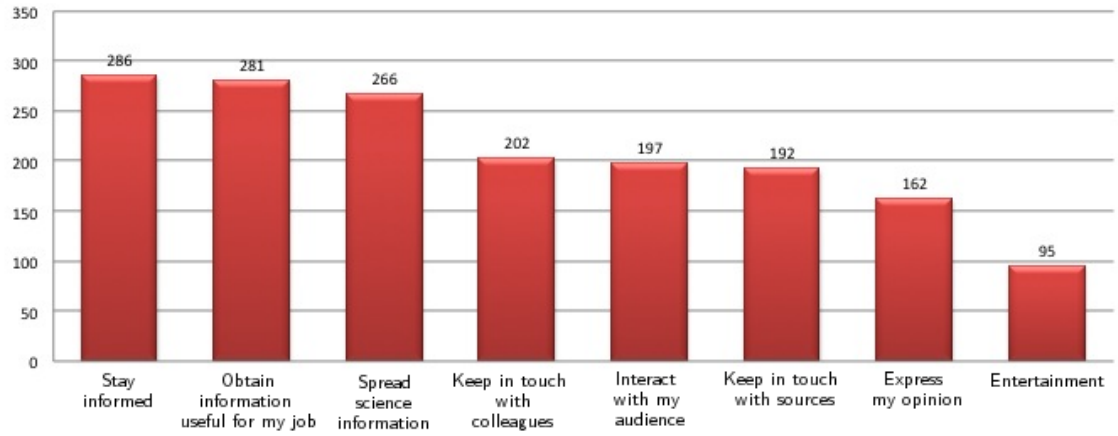

Figure 4. Uses of the social networks, ranked in order of importance (calculation based on this research).[49]

Among the members of the sample, 96% are Twitter users, which also happens to be the most widely used platform. Its similarity to teletype messages is one of the reasons that have influenced the most the success of this microblogging service, which also features many filtering and alerting tools ("Twitter gives you clues, it tells you where to go" – SJ08). Figure 4 also shows the importance of social networks in encouraging interaction with the audience: 98% of the journalists surveyed said that new technologies have positively influenced the interaction with the public, and 80% answer the comments of their followers (though only 53% do so regularly, and only 27% participate in conversations). Journalists are aware of the change in the relationship with citizens: "being no longer isolated, journalists cannot just speak in a top-down perspective" (SJ31). The development of new technologies involves the multiplication of voices in the public debate: whereas in the past institutions and journalists were the only stakeholders actively involved in the process, now "users are part of the equation" (SJ34).

The in-depth interviews show a generally positive attitude towards new technologies. Sporadic resistance derives rather from the uncertainty about the business model that new technologies impose on science journalism. Since ICTs have been pervading our daily life in a natural and unobtrusive way, there has been a lack of planning and vision for the future in incorporating them in the practices of the newsroom. The Internet and the social networks enable to access content free of charge, and this is exactly where the two journalism models — traditional and digital — are in conflict: "coming from an industry charging you for the information, it collides […] as long as they can get free information on the web, [users] are not going to pay for it" (SJ14). A few respondents see online information as a form of competition and sometimes they feel forced to produce content for digital platforms without charging for it ("We do more for less money" – SJ20). The delicate balance between business model and workload is further complicated by the issue of the integration of formats. By their nature, ICTs encourage the dissemination of content that can be accessed across different platforms ("People are multi-format now" – SJ29) and that may have generated the fear of having common information formats disappear. However, many

journalists point to a reinvention of formats and some even see the possibility to reaffirm the prestige of journalists as a parameter to differentiate reliable news organizations ("There won't be many newspapers as now, but national ones will be important, with a significant focus on certain subjects, with the guarantee of those who write there and in-depth analysis. For example, *Le Monde Diplomatique*, which is published once a month, and its sales have even increased" – SC14). According to other respondents, however, the future of science information is not threatened by the development of new technologies, but by a general crisis affecting journalism, caused both by factors related to the social sphere ("Journalism is going through a terrible crisis, regardless of the format, because society does not quite understand the need to finance a job like this, which apparently does not generate or manufacture anything. But it is essential to have a democratic condition, an informed and educated public opinion" – SC29) and by the professional themselves ("A job not so well done makes people go away, the press should not blame the Internet for its fall" – SJ31).

Another factor behind the resistance to the incorporation of new technologies can be found in two different gaps. The first, more obvious one is the generation gap. The second, which has emerged even more strongly throughout the interviews, is the professional category gap. To some, the alleged "deification of the paper" (SC31) has created a certain hostility climate that has hampered the integration of the digital media: a respondent admits that in their workplace "until a year ago, Twitter was censored because it was considered as a distraction, mere entertainment, instead of a working tool" (SJ18). At the same time, other journalists say that sometimes too much importance is attributed to such innovations, thus forgetting the quality of the news, especially in relation to the time of publication — as already noted ("In my case, fortunately, what is still valued the most is a certain quality level, the ability to explain things well, rather than the fact of getting there five minute before or five minutes after" – SJ30).

5. Conclusions

One of the main conclusions of the research presented here is that more than two thirds of Spanish science journalists have a positive (72%) or very positive (19%) opinion on the introduction of new information and communication technologies (ICTs) in science journalism. However, the professionals that participated in this research identify a few drawbacks generated by the new media in their work. The first obstacle outlined by Spanish science journalists is that the adoption of technologies has basically occurred without media companies offering any training on the subject and, what is worse, without a plan to activate a better coordination and development mechanism within the news organisations themselves. On the negative side, there is also time management. Journalists note that thanks to the use of ICTs they do not need to "hit the streets" anymore. Among the reporters interviewed, 65% believe that it is no longer necessary to go and find the news because new technologies have become an important tool for finding information, without having to leave the newsroom.

In addition, the professionals surveyed unanimously maintain that technology enables a better dissemination of scientific information. Similarly, 88% of professionals also appreciate the speed of the digital media, but consider that such speed in the dissemination of information is now overrated, and therefore nearly half the journalists acknowledge that the time devoted to investigation has decreased ("We are just left with the title — this happens ever more frequently — and that title requires many nuances" – SJ05).

The influence of new technologies on the accuracy of the information divides Spanish science journalists. Among them, 32% think ICTs have a positive effect for its increase, whereas 27% think they do not have any effect at all. However, 30% of the interviewees distrust new technologies because they think their sources often are neither confirmed nor verified.

In any case, 96% of the journalists interviewed think that social networks are powerful tools in their profession. Thus, Spanish journalists specialising in science say that they use 2.0 tools to stay informed, to read up and to maintain direct contact with the sources. In addition, a few journalists admit that new technologies allow them to check the veracity of the news in real time. The 2.0 platform that is most used by the journalists surveyed (96%) is Twitter, especially because it is very similar to the old teletype message system used by news agencies.

Another important conclusion of this research is that science journalists think the interaction with the audience is very positive. The vast majority (98%) of respondents said that new technologies have positively influenced the interaction with the public, and 80% of them usually reply to the comments of their followers.

The new media allows for a significant increase in the number of subjects that release information, breaking the exclusive right to broadcast news of the mainstream media, i.e. press, radio and television. However, the multiplicity of information sources may not always produce benefits, and there have been many instances of hoaxes, rumours and false information being spread this way. Therefore, the integration of formats has also led to some problems emerging in today's newsrooms. Journalists believe ICTs encourage the dissemination of content that can be accessed across different platforms, but this also leads to jobs being lost and professionals being exploited. Nevertheless, the study notes that — in the opinion of the respondents — the future of science information is not threatened by the development of new technologies, but rather by the general crisis journalism is going through.

Without entering the false debate on whether journalism is necessary, we believe that while the participation of citizens should not be vetoed, it is not possible to make contributions of this type the only sources of information. Despite some apocalyptic predictions, journalism will live on for many years to come. But it should also break the old myth of the exclusivity of information and leave room to citizens, who are increasingly involved in direct participation. Therefore, based on our study and analysis of science journalism in Spain, below are a few suggestions to improve the professional practice:

1. Increase the training in the field of new technologies: news organizations should better meet the ICT-related training needs of their professionals. This would improve

the situation and prevent the journalists' fear of new media, helping the coordination and planning of science departments.

2. Validate information and spread knowledge: the speed of new media should not become the foundation of a new working method by which only speed counts, to the detriment of accuracy. The new media, like Twitter for example, is very immediate, yet it can hardly reproduce complex knowledge or thinking.

3. Rethink the mandates and tasks of science journalists: it is necessary to weigh up the professionals' workload as it has greatly increased over the past few years. Science journalists have to address three fundamental aspects: a) the traditional production of news; b) controlling the dissemination of the news through new media; and c) responding to the feedback from readers. The sum of the three scenarios entails a work overload for journalists and decreases the time available to research, compare, enrich, verify and edit scientific information.

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Notes and references

[1] T. O'Reilly (2005), *What is Web 2.0: Design patterns and business models for the next generation of software*, retrieved from http://oreilly.com/web2/archive/what-is-web-20.html.

[2] R. Kunelius (2001), *Conversation: a metaphor and a method for better journalism?*, *Journalism Studies* **2**(1): 31–54.

[3] U. Hedman and M. Djerf-Pierre (2013), *The Social Journalist*, *Digital Journalism* **1**(3): 368–385.

[4] E. Amend and D.M. Secko (2011), *In the Face of Critique: A Metasynthesis of the Experiences of Journalists Covering Health and Science*, *Sci. Commun.* **34**(2): 241–82.

[5] M. Bauer et al. (2013), *Global Science Journalism Report. Working conditions & Practices, Professional Ethos and Future Expectations*, Science and Development Network, London, retrieved from: http://eprints.lse.ac.uk/48051/1/Bauer_Global_science_journalism_2013.pdf.

[6] A. Williams and S. Clifford (2009), *Mapping the Field: Specialist science news journalism in the UK national media*, Risk, Science and the Media Research Group, Cardiff University School of Journalism, Media and Cultural Studies, retrieved from: http://www.cardiff.ac.uk/jomec/resources/Mapping_Science_Journalism_Final_Report_2003-11-09.pdf

[7] V. Colson (2011), *Science blogs as competing channels for the dissemination of science news*, *Journalism* **12**(7): 889–902.

[8] This paper is part of the research project *El periodismo científico en España y las nuevas tecnologías de la información (TIC): mapa de situación y propuestas de actuación para mejorar los procesos comunicativos* [Science journalism in Spain and new information technologies (ICTs): a picture of the situation and proposals to improve communication processes], led by S. Cortiñas-Rovira, CSO2011-25969, Ministerio de Ciencia e Innovación (MICINN) 2012–2014.

[9] T. Bubela and T. Caulfield (2004), *Do the print media ''hype'' genetic research?*, *Can. Med. Assoc. J.* **170**(9): 1399–407.

[10] G. Revuelta (2006), *Salud y medios de comunicación en España*, *Gac. Sani.* **20**: 203–208.

[11] S. Cortiñas-Rovira (2008), *Metaphors of DNA: a review of the popularisation processes*, *JCOM* **7**(1) A02.

[12] H.P. Peters et al. (2008), *Interactions with the mass media*, *Science* **321**(5886): 204–205.

[13] E. Racine et al. (2006), *Hyped biomedical science or uncritical reporting? Press coverage of genomics (1992–2001) in Quebec*, *Soc. Sci. Med.* **62**(5): 1278–90.

[14] T. Bubela et al. (2009), *Science communication reconsidered*, *Nat. Biotechnol.* **27**: 514–18.

[15] N.A. Holtzman et al. (2005), *The quality of media reports on discoveries related to human genetic diseases*, *Community Genet.* **8**(3): 133–44.

[16] C. Pont and S. Cortiñas (2011), *Journalistic practice in risk and crisis situations: significant examples from Spain*, *Journalism* **12**(8): 1052–66.

[17] A. Cassels et al. (2003), *Drugs in the news: An analysis of Canadian newspaper coverage of new prescription drugs*, *Can. Med. Assoc. J.* **168**(9): 1133–37.

[18] M. Gasher et al. (2007), *Spreading the news: Social determinants of health reportage in Canadian daily newspapers*, *Canadian J. Commun.* **32**(3): 557–74.

[19] See note 18.

[20] F. Chew, J. Mandelbaum-Schmid and S.K. Gao (2006), *Can health journalists bridge the state-of-the-science gap in mammography guidelines?*, *Sci. Commun.* **27**(3): 331–351.

[21] G. Geller et al. (2005), *Scientists' and science writers' experiences reporting genetic discoveries: Toward and ethic of trust in science journalism*, *Genet. Med.* **7**(3): 198–205.

[22] P. Conrad (1999), *Uses of expertise: Sources, quotes and voices in the reporting of genetics in the news*, *Pub. Underst. Sci.* **8**(4): 285–302.

[23] E. Hijmans, A. Pleijter and F. Wester (2005), *Covering scientific research in Dutch newspapers*, *Sci. Comm.* **25**(2): 153–76.

[24] See note 4.

[25] D. Hodgetts et al. (2007), *Constructing health news: Possibilities for a civic-oriented journalism*, *Health* **12**(1): 43–66.

[26] See note 2.

[27] See note 4.

[28] See note 4.

[29] See note 3.

[30] G. Brumfiel (2009), *Supplanting the old media?*, *Nature* **458**(19): 274–277.

[31] M. McLuhan (1964), *Understanding Media: The Extensions of Man,* McGraw-Hill, New York, U.S.A., pp. 23–24.

[32] J.D. Bolter and R. Grusin (1999), *Remediation. Understanding New Media*, MIT Press, Cambridge, U.S.A.

[33] M. Castells (1996, second edition 2000), *The Rise of the Network Society, The Information Age: Economy, Society and Culture Vol. I*, Blackwell, Oxford, U.K.

[34] See note 33, M. Castells (1996), p. 440.
[35] See note 33, M. Castells (1996), p. 441.
[36] D. Harvey (1990), *The Condition of Postmodernity. An Enquiry into the Origins of Cultural Change*, Blackwell, Oxford, U.K.
[37] A.J. Greimas and J. Courtés (1979), *Sémiotique. Dictionnaire raisonné de la théorie du langage*, Hachette, Paris, France.
[38] N. Negroponte (1995), *Being Digital,* Knopf, New York, U.S.A., p. 19.
[39] Accountability is an ethical concept that refers to transparency and taking on responsibility by institutions, companies and public or private organisations.
[40] H. Rheingold (2002), *Smart Mobs: the Next Social Revolution*, Perseus Publishing, Cambridge, MA, U.S.A., p. 15.
[41] See note 1.
[42] Cited in P. Bullón (1999), *Algo está cambiando. La prensa frente a las nuevas tecnologías*, *Sala de Prensa* **2: 5**, http://www.saladeprensa.org/art35.htm [retrieved on 15 May 2013].
[43] H. Jenkins (2004), *The cultural logics of media convergence*, *Int. J. Cultural Studies* **7**(1): 22–43.
[44] D. Domingo, T. Quandt, A. Heinonen, S. Paulussen, J.B. Singer and M. Vujnovic (2008), *Participatory Journalism Practices in the Media and Beyond*, *Journalism Practice* **2(**3): 326–342.
[45] C. Pont, L. Codina and R. Pedraza (2009), *Comunicación de riesgo y sistemas de información en la web: cinco modelos informativos*, *Prof. Inform.* **18**(4).
[46] C. Ruiz et al. (2011), *Public Sphere 2.0? The Democratic Qualities of Citizen Debates in Online Newspapers*, *Int. J. Press. Polit.* **16** (4): 463–487.
[47] M. Castells (2001), *The Internet Galaxy: Reflections on the Internet, Business and Society*, Oxford University Press, New York and Oxford, p. 137.
[48] See note 36.
[49] The vertical axis values represent the sum of the numerical values assigned by respondents to each of the possible answers, according to an increasing order from 1 to 8.

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