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"Everything is plentiful—Except attention". Attention data of scientific journals on social web tools

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ABSTRACT

One hundred scientific and scholarly journal web sites were investigated to find out their use of social media tools and to examine attention data revealed by them. Seventy-eight scientific journals used social media tools, RSS being the most common. Interactive social media tools – Facebook, Twitter and blogs – were present on 19 journal web sites. Attention data were operationalised as liking, commenting or sharing postings on Facebook, Twitter or blog texts or linking to articles, liking a YouTube entry or following a journal on Twitter. Facebook and blog sites of the journals had varying roles with respect to content generated by readers and the journal, and the amount of attention data received by the journals' Facebook, Twitter and blog sites also showed great variation. In scientific communication, social media have a role of their own, complementing that of scientific journals, and their active use indicates the clear demand for them. Attention is difficult to measure also by social media, but their interactive features obviously indicate one part of it, and attention economy presents a fruitful viewpoint for studying scientific communication by providing relevant and useful concepts that describe its characteristics and factors that influence the attention it receives.

1. Introduction

Scientific journals and social media tools have two characteristics in common: they are means for publishing information and for paying attention to somebody's work. *Attention can be defined as focused mental engagement on a particular item of information* (Davenport & Beck, 2001, p. 20). It has also been defined as time spent interacting with someone or something (Simon, 1971, p. 41) and in scientific communication, as citations (Frank, 2002, p. 15). *In an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes: attention* (Simon, 1971, p. 40). To consume information, we must invest our own attention (Davenport & Beck, 2001, p. 11), and scientific communication can be described as a market where information is exchanged for attention (Frank, 2002, p. 16). You can buy attention (called advertising), beg for it (through public relations), bug people one at a time to get attention (called sales) or earn attention online, which is called social media marketing. This involves creating something interesting and publishing it online for free: a YouTube video, a blog, a research report, photos, a Twitter stream or a Facebook page (Scott, 2009, p. 48).

Attention data can cover many things that have some kind of "digital footprint", such as books that I buy, read, recommend or wish for, web sites and blogs that I read, my bookmarks, blog rolls and RSS (Meyer, 2006). However, attention is difficult

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to document and a scarce currency. According to Sterling, we have access to a wealth of data and information, but what is increasingly important is the process by which we figure out what to look at: "in the information economy everything is plentiful – except attention" (1992, p. 3). Audience attention is limited and zero-sum, which means that gains in attention share for one medium can be made only at the expense of another. As the amount of information increases, the demand for attention increases (Davenport & Beck, 2001, pp. 7, 11, 94).

Social media enable readers to like or comment a posting, i.e. evince attention, but they have not been studied from this viewpoint in a scientific context. Social media that apply Web 2.0 tools – or the participative web (Coyne, 2010) – have started to find their way into scholarly communication genres (Borgman, 2007; Priem & Hemminger 2010; Torres-Salinas & Delgado-Lopez-Cozar, 2009; Wang, Jiang, & Ma, 2010). Blogs and Wikis facilitate conversations across a vast geographical expanse, and information pushing devices, like RSS feeds, permit continuous alerting to the latest ideas (Giustini, 2006). Social network web sites allow visitors to register and connect to each other in order to communicate or share resources (Thelwall, 2008). According to Borgman (2007), discussion lists, blogs, RSS feeds, etc. contain important discussions, facts and reports that are part of the scholarly discourse of a field, although they would be too informal to be considered publications. The possibilities of social media tools in post-publication review of publications have also been considered (Borgman, 2007). Experiences of open peer-review have, however, proven problematic due to missing blindness and objectivity of the review, and missing uniformity of the indicators of use in the online environment (Anderson, 2012, p. 2).

Besides a journal, some scientific publishers already provide on their web sites social media tools such as YouTube, Twitter, Facebook or a blog. They enable both publishing of views and works and expressing and receiving reactions and comments. Therefore, attention data (Meyer, 2006) or indicators of use (Borgman, 2007) can appear in various forms.

Earlier studies of social media in a scientific context have included analyses of web page links (e.g. Thelwall, 2008), blogs as support for scientific communication (Dolmaya, 2011; Wang et al., 2010), content analysis of blogs (e.g. Aharony, 2009; Bar-Ilan, 2005; Clyde, 2004; Savolainen, 2011; Torres-Salinas, Cabezas-Clavijo, Ruiz-Pérez, & López-Cózar, 2011), the use of the tools in academic library web sites (Chua & Goh, 2010; Tripathi & Kumar, 2010) and questions of reliability of information on Web 2.0 (Adams, 2010). They have also been used to compile research data (e.g. Halper, 2008). Micro-credits in scientific publishing were studied by Casati, Origgi, and Simon (2011), but their focus was not on attention data. Attention has been studied from an economy viewpoint by Frank (2002), Yardi, Golder, and Brzozowski (2009b) and e.g. Falkinger (2008). Skågeby (2009) studied social metadata in the framework of gifts and Cronin and Shaw (2002) examined indicators of online recognition such as mentions occurring on external home pages. Priem and Hemminger (2010) have studied science and the social web, mentioning also publisher-hosted comment spaces, Haustein and Siebenlist (2011) examined journal usage by applying social bookmarking and Eysenbach (2011) analysed the connection between Tweets and citations. However, the focus in these articles has not been on scientific attention data received through social media.

The purpose of this study is to examine the availability of social media tools on the web pages of scientific or scholarly journals, and to study their contents and what kind of attention data they possibly include. The following research questions were posed:

1. What social media tools are used on scientific or scholarly journals' web sites?
2. What kind of attention data can be found? Does it include attention to published articles? What is it focused on?
3. What are the topics in the blog, Facebook and Twitter postings on scientific or scholarly journals' web sites?

2. Materials and methods

One hundred scientific or scholarly journals were chosen on the basis of their 2010 journal impact factor (JIF) by selecting the 10 top journals in the following fields of research from The Thomson Reuters ISI Web of Knowledge (Journal Citation Reports) database: applied physics, computer science, evolutionary biology, general and internal medicine and inorganic chemistry from natural sciences, and communication, education and educational research, information science, linguistics and sociology from social sciences. If the same journal was mentioned in the lists of more than one field, it was recorded only once. If this resulted in a field of research having fewer than ten journals, it was supplemented by the next journal(s) from the Journal Citation Report (JCR) list. The final list of journals is given in Appendix. The journals represent both major fields with plenty of scientists and a high frequency of publishing articles, resulting in higher values in the JIF, and fields with a smaller number of scientists, producing a smaller number of articles and resulting in lower JIF rankings.

Quantitative methods were used to describe the application of social media tools on scientific or scholarly journal web pages. Although a set of 100 journals does not provide a basis for any generalisations, it at least serves to illustrate the phase of current development. The data are described through statistical tables.

To record the existence of social media tools, the sites of all the 100 journal web pages were visited on April 17th, 2012, except that of the European Journal of Inorganic Chemistry, which was visited on April 19th, and the Journal of Web Semantics on April 20th, due to journal changes in the data.

Attention data were operationalised as liking, commenting or sharing postings, mentioning an article in a Facebook, Twitter of blog text or linking to it, following a journal on Twitter and viewing a YouTube entry. Because RSS and bookmarking or sharing tools are used merely for one-way communication, such as informing about new articles, they were not used as sources of attention data in this study.

To study attention data, the Facebook sites of the journals were visited on April 20th, 2012. The data contain the number of postings, links to articles, liking, commenting and sharing information. Blog, YouTube and Podcast sites were visited on April 23rd, and Twitter sites on April 24th. Twitter data include the number of Tweets, whether they originated from the journal or outside it, the number of other Twitter pages the 15 journals followed and how many followers the journal Twitter had.

The qualitative content analysis of the postings on blog, Twitter and Facebook only concerned the topic, whether it originated from the journal or outside it, whether it was connected to an article and the number of comments or likings it received. The dates mentioned in the results, such as 8/3 (meaning March 8th), refer to the publication date of a posting. The varying character of social media necessitates the research material to correspond to the situation on a certain date. Even though the research material concerning March 2012 was compiled the following month, the content of a Facebook site may still be slightly different on different days in April.

The borderline between the web pages of the publisher and the journal is sometimes blurred: links to Facebook, Twitter or a blog lead to the corresponding page of the organisation that publishes the journal, not to pages representing the journal itself. In this study only the social media tools of the scientific journal itself were registered and those belonging to the publisher were excluded. In contrast to these are journals resembling an article database, the content of which is disseminated by Web portals. The potential social media tools of these portals were also excluded from this study.

3. Theory: social media tools as a source of attention data

Formal publications deal with the end points of the scholarly communication process (Smith, 2008, p. 15), while social media tools enable quick communication of shorter, less formal messages from one to many, including publicity not enabled by e.g. e-mail. The key ideas behind Web 2.0 are: individual production and user-generated content, harnessing the power of the crowd, data on an epic scale, architecture of participation, network effects and openness (Anderson, 2007).

User-generated content may include text, audio, video material or pictures that can be published e.g. through blogging, podcasting, social bookmarking, social networking or Wiki writing (Gray, Thompson, Clerehan, Sheard, & Hamilton, 2008), on Facebook or Twitter or by publishing e.g. videos on YouTube. Participation can range from professional artists displaying their work to amateur hobbyists seeking a like-minded community (Yardi, Golder, & Brzozowski, 2009a, p. 2071). However, participation and user-generated contents may consist not only of user-generated texts but also of passive reading or viewing. This produces attention data. We cannot measure the amount or strength of attention itself. As its proxy, Simon (1971) has used time spent on a message, whereas Frank (2002) used citations. Attention data can also consist of other elements that reveal somebody's attention on a message. It can mean a visit to a web site, linking to it, "liking" somebody's text or following somebody on Twitter. An article can be cited, bookmarked, tweeted or blogged, all activities that reflect impact (Prier & Hemminger, 2010) – or attention. These all make the attention received by a specific site, author, article or other web publication visible, even quantifiable. Tweets have been found to correlate with citations from Google Scholar (Eysenbach, 2011, p. 9).

There is a vast imbalance between internet information and the attention it receives. According to Simon (1971), human beings are essentially "serial devices" that can "attend to only one thing at a time". The growing amount of scientific information does not increase the amount of potential attention, and this makes attention scarce. A common topic in publications concerning attention is the need for filters to "tame" the information overload (Priem & Hemminger, 2010; Priem, Taraborelli, Groth, & Neylon, 2011; Simon, 1971; Sterling, 1992) and to help in choosing what to pay attention to.

To attract attention, an internet site should be relevant, it should communicate a sense of ownership or belonging through co-creation (in the meaning of user-generated information) and recognition, it should engage the reader by interactivity, competition, entertainment, narration or production values, and it should be convenient in the meaning of quick downloads, intuitive navigation and moderate pieces of information (Davenport & Beck, 2001, p. 115).

According to Yardi et al. (2009a, p. 2072), the reader drives the attention economy, and it is attention that binds together the reader, author and content in a media. The relationship between reader and author can be described through two kinds of models: in the star-fan model, stars receive more attention than they give, while fans pay out more attention than they receive (Goldhaber, 1997; Yardi et al., 2009a, p. 2072). Krishnamurthy, Gill, and Arlitt (2008) found in their study of Twitter three groups of users: broadcasters who have more followers than they themselves follow, acquaintances in whose relationships there is reciprocity and miscreants (or evangelists) who follow a much larger number of people than they have followers.

Davenport and Beck (2001, pp. 80–82, 102, 105) mention factors that enhance attracting attention. Nonlinear structures, such as a catalogue or hypertext Web, enable a nonlinear attention flow. Web sites make it easy for a reader to enter and leave the information stream. Informational messages that are lifelike and realistic are more likely to hold attention than those that are not. More active media engage a higher level of attention which is also more easily maintained while attempting to achieve a specific objective or goal that is meaningful to job or life. This is enhanced by authoritative content. To hold attention, information flow should not be stopped or interrupted. The most successful attention structuring tools try to retain attention to a given message, but also make it easy to change the informational context. One factor behind the success of the Web (and TV and radio) is that it is easy to "change channels" or alter the flow of the attention stream. Moreover, a short story, focusing on a particular audience and applying several publishing forums is likely to secure attention.

Table 1
Social media tools in each field of research in March 2012.

Discipline represented by the journals	Interactive tools				One-way tools		Total interactive + one way	Total
	Blog	YouTube + Podcast	Facebook	Twitter	RSS	Soc. bookmark[a]		
Sciences								
Applied physics				2	8	1	2 + 9	11
Computer science	1		2	2	4	1	5 + 5	10
Evolutionary ecology				3	9	2	3 + 11	14
General and internal medicine	4	2 + 2	6	7	6	2	21 + 8	29
Inorganic chemistry	1			1	7	2	2 + 9	11
Total	6	4	8	15	34	8	33 + 42	75
Social sciences								
Communication				1	7	1	1 + 8	9
Education and Educational research					5	2	0 + 7	7
Information science					4	4	0 + 8	8
Linguistics					6	1	0 + 7	7
Sociology			1	1	7	2	2 + 9	11
Total	0	0	1	2	29	10	3 + 39	42
Total all fields	6	4	9	17	63	18	36 + 81	117

[a] Social bookmark or share option.

Attention can be divided into captive or voluntary, aversion-based or attraction-based and front-of-mind or back-of-mind attention. A person pays captive attention to teasers in a cinema before the film itself starts, which receives voluntary attention. If we seek information to avoid a negative experience, the attention is aversion-based, but attraction-based if we expect a positive experience. Front-of-mind attention is conscious, focused and explicit, while your brain may be paying back-of-mind attention to several other things around you (Davenport & Beck, 2001, pp. 22–23). If we compare attention data produced in social media tools with citations (Frank, 2002, p. 15), both have characteristics of both voluntary and captive attention, but the former can be considered more voluntary and the latter a little more captive, because citations are part of the ethical use of other authors' works.

4. Results

Web 2.0 tools are not yet a common feature on scientific journals' web pages. Table 1 presents the results of this study of one hundred scientific journals, each category represented by ten journals. The social media tools on the pages of these journals are mostly used to announce new updates and articles by RSS. This kind of one-way communication could be found on 63 of the 100 journal web sites studied. The more interactive tools Facebook (FB), Twitter (TW), blogs, Podcast and YouTube are much less common. There were 36 such tools available on 19 journal web sites, of which eight represented medicine, three evolutionary biology, three computer science, two physics and one each chemistry, communication and sociology. Twenty of the journals did not provide their readers with any social media tools (Appendix).

Nine journals in this data had a Facebook site of their own (Table 2). Eight of them could be studied, while on one of them postings were not available. They had 131 postings on their Facebook walls, 91 of which were linked to an article or other resources published by the journal (69% of the cases; Table 2). Four journals published at least 20 Facebook postings a month and the rest, 2–13. For active publishers, Facebook seems to be a relevant tool whose role is to focus the readers' attention on either new articles or current topics.

With respect to linking to the articles or blogs, the journals differed from each other decisively. Annals of Internal Medicine (AnnInternMed), British Medical Journal (BMJ), Journal of the American Medical Association (JAMA), Lancet, MIS Quarterly (MIS Q) and New England Journal of Medicine (NEJM) formed a group in which more than 70% of Facebook postings were linked to the journal. The role of Facebook in this group seems to be to announce new publications in the journal or its blog, whereas in the other group formed by Gender and Society and Journal of the American Medical Informatics Association (JAMIA), only 0–10% of Facebook postings were connected to the journal. In this group Facebook is used more to announce about resources elsewhere. Gender and Society (Gender Soc) is an example of journals whose Facebook reflects more the readers' interests than the content of the journal.

Postings not connected to scientific articles or blogs discussed current topics, such as daylight savings, linking to earlier articles concerning it (AnnIntern Med FB 12/3), NHS reform (BMJ TW 12–19/3) or reminded readers about International Women's Day (Gender Soc and Lancet FB 8/3). Conversation about scientific publishing included topics like physician professionalism in social media (AnnInernMed FB and TW 21/3), a new forum or edition (JAMA FB 14/3 and 23/3; NEJM FB 13/3 and 17/3; NEJM TW 13/3, 17/3, 19/3, 21/3), freelance scientific journalists (Lancet 14/3), post-publication peer-review (JAMIA FB 30/3; BMJ TW 26/3) and open access publishing (PLoSMED TW 7/3, 15/3, 18/3, 20/3, 24/3, 26/3, 27/3).

Table 2
Attention data on Facebook sites of 8 journals.

Journal	Months of existence by March 2012	People talking about this	March 2012							
			Postings	Postings linked to the journal		A Like	B Comments	C Share	A+B+C	A+B+C/ posting
				n	%					
Annals of Internal Medicine	23	–	29	22	76	61	2	7	70	2.41
Archives of Internal Medicine	31	58	–	–		–				–
British Medical Journal	24	756	24	17	71	117	29	42	188	7.8
Gender & Society	9	21	13	0	0	6	0	0	6	0.67
Journal of the American Medical Association	32	707	9	9	100	141	7	25	176	19.55
Journal of the American Medical Informatics Association	16	15	10	1	10	2	0	0	2	0.18
Lancet	23	1621	21	17	81	745	80	398	1223	58.24
MIS Quarterly	2	41	2	2	100	5	0	0	5	2.5
New England Journal of Medicine	33	14,382	23	23	100	4766	714	1274	6745	293.26
Total			131	91						

Table 3
Attention data on Twitter in March 2012.

Journal	Tweets in March	Tweets of the journal itself in March	% of Tweets from outside	Followed by (total)
Gender & Society	89	41	53.9	498
Trends in Ecology & Evolution	3	3	0	422
Cyber-Psychology	2	2	0	826
Journal of the American Medical Informatics Association	5	1	80.0	897
Dalton Transactions	63	31	50.8	833
Evolutionary Applications	6	6	0	1262
American Naturalist	10	10	0	633
New England Journal of Medicine	96	96	0	62,747
Lancet	161	15	90.7	34,601
Journal of the American Medical Association	34	34	0	17,344
Annals of Internal Medicine	24	24	0	3057
PLoS Medicine	74	21	71.6	8607
British Medical Journal	303	48	84.2	34,678
Archives of Internal Medicine	37	1	97.3	3473
Nature Materials	25	14	44.0	5371
Nature Photonics	38	11	71.1	240

Attention data are most prolific on Facebook's like, comment and share information (Table 2). The more active half of the Facebook sites received more than a hundred recordable indications of attention through liking, commenting and sharing by readers. Two journals yielded thousands of such actions. Even a Facebook site with "only" nine postings might receive more than a hundred indications of attention. In the background are factors like large readership, meaning a lot of researchers in the field, and relevance for them. What else it requires in the form of e.g. community or engagement (Davenport & Beck, 2001, p. 115) is beyond the scope of this study, but would deserve an investigation of its own.

There is also a measure of attention, "People talking about this", published by Facebook and consisting of posting to a page's wall, liking, commenting, sharing content on the page or e.g. answering a question (Wassermann, 2011). It is related to attention data in Table 2, but is still not identical with them, and represents a longer period than March.

Especially widespread attention was focused on NEJM Facebook, which published weekly Image Challenges, medical photos with a question on what the diagnosis would be. These received an average of 31 comments, 207 likings and were shared 56.7 times/posting, which makes their potential attention still wider. The photos represented the topic of the journal but were not necessarily connected to its articles. Likewise, opinion polls (BMJ FB 13/3, 20/3, 27/3; BMJ TW 20–21/3, 27/3) received even more than 2000 votes (BMJ FB 22/3). This supports the view that relevant and authoritative content, and messages that are realistic and interactive, receive a lot of attention (Davenport & Beck, 2001, p. 80). Attention is manifested in the liking, commenting and sharing in the postings and is especially obvious in the comments concerning the full text availability of the journal articles (BMJ 19/3; Ann Internal Med 12/3).

Two links were shared by two different journals. In one of them the topic was search engine optimisation, titled BMJ upsets Google. It was first published on a BMJ blog, Facebook and Twitter (23/3) with a link to the blog, but also on JAMIA Facebook wall (23/3) as a Tweet. The BMJ blog was also mentioned on JAMIA Facebook on March 9th, 16th and 30th. In another case, Nature Materials announced its new issue on both its own Twitter and that of Nature Photonics (23/3).

Sixteen journals used Twitter. The Twitter site of a journal displays the number of its followers, i.e. those who receive information (a Tweet) on its updates, most of which concern new articles or blog entries. The number of followers varied between 240 and 62,747 and reflects the attention received by the site (Table 3). All the journals in Table 3 belong to the group of broadcasters (Krishnamurthy et al., 2008) who have more followers than they themselves follow, or stars (Goldhaber, 1997; Yardi et al., 2009a, p. 2072). The ratio between the number of followed and following sites ranges between 7.84 and 1337.33. Also Tweets from outside the journal indicate attention. There are no options to "like" the Tweets, and attention data are less obvious on Twitter than on Facebook. Comments were rather rare, although there were a few questions and answers to them (NEJM 14/3; Dalton Transactions 20/3; Lancet 21/3; BMJ 19/3, 27–28/3).

Seven journals had both Facebook and Twitter sites. In five cases Twitter had more entries and in two cases Facebook did (Tables 2 and 3). Some of the Facebook content seemed to be created for it, although it also contained links to articles and blogs, whereas Twitter apparently reflected content published elsewhere, due to the limited length of the messages. The same information was published on both Facebook and Twitter by NEJM (7–8/3, 13–15/3, 17/3, 20/3, 22/3, 28–29/3) and by BMJ (13/3, 20–22/3, 26–28/3, 30/3). Publishing the same information in several different forums enhances its visibility (Davenport and Beck, 2001, p. 80).

The blog practices of the journals differ widely from each other. Some of the blogs publish columns of specialists in various fields, while others mostly inform about newly published or otherwise current articles in the journal. The role of the latter ones is close to that of Twitter and Facebook. The six blogs studied (BMJ Case Reports Blog, Cochrane Database of Systematic Reviews, Dalton Transactions, JAMA, MIS Q and NEJM) had 2–26 postings that could receive like, share or comment actions, but many of them received none. The two BMJ blog postings were Tweeted (twice), the two MIS Q postings commented twice and the 19 NEJM postings three times, and the NEJM blog postings were recommended 2454 times. In the case of BMJ,

only one of its 22 group blogs was chosen for the study. To conclude, blogs contain attention data but not much that could serve as a basis for comparison between journals.

A Podcast option was provided on the NEJM, Lancet, JAMA and BMJ sites and included mostly interviews, but no attention data concerning podcasts were available. A YouTube connection was offered by the BMJ and the NEJM. The BMJ added one file in March and the NEJM added five. Attention to YouTube sites is reflected in the number of viewings of the files. The BMJ files had been viewed 280,057 and NEJM files 626,566 times (total viewings by April 2012).

5. Discussion

Social media tools are not yet common on scientific and scholarly web sites. The existing social media have very varying roles. They announce new articles, serve as discussion forums and contribute to professional knowledge. As a rule, they do not at present serve as post-publication reviews, but for an author it must be rewarding to see the attention an article receives in Tweets, Facebook postings, like or share information. On some sites attention data yield huge figures, contributed also by a large readership. The roles of Facebook and Twitter and some blogs were rather close to each other in cases where they informed about newly published articles. Attention data were most readily available on Facebook, but could be traced also on Twitter and blogs.

The use of social media tools adds to the information content produced by the journal. Some of the tools possibly act as information filters, by informing about new articles and the readers' contribution: liking, recommending, commenting, tweeting or sharing links to articles. Another role is in sharing of information, such as medical case reports that are not in the form of a scientific article but may nevertheless be relevant for a reader. Such social media tools contribute to both professional and scientific knowledge.

Several factors seem to support attracting attention to scientific social media web sites, namely relevance, authority and meaningfulness of contents, activity and interactivity, focusing on a particular audience, community through co-creation and shortness of stories, although they may be linked to longer articles. These characteristics have been realised in a great variety of ways. Attention is evidenced by substantial participation in polls and Image Challenges, comments, liking and sharing postings.

In scientific communication social media have a role of their own, complementing that of scientific journals. They give readers' views visibility, and enable the publisher to publish relevant information in formats other than scientific articles. Their active use indicates the clear demand for all this. The social media strategies of the sites seem to differ e.g. with respect to user-generated content. There are sites where most of the content comes from outside the journal, and discussion e.g. on Facebook concerns relevant subjects but hardly has any connection to the articles of the journal. On other sites user participation is apparent, but the contents on Facebook, blogs or Twitter are nevertheless closely connected to the content of the journal.

6. Conclusions

So far, the connection between a publication and its reader has been described as impact. In the case of social media, impact is not equally evident as in the case of citations in a scientific article, although attention is quite apparent through liking, tweeting or recommending an article. Therefore, attention has been used in this paper to describe readers' reactions to published items in social media. Attention economy presents a fruitful viewpoint for studying scientific communication in social media by providing relevant and useful concepts that describe its characteristics and factors that influence the attention it receives. Attention is difficult to describe or measure also in social media, but their interactive features obviously illustrate one part of it, and would deserve to be studied in greater detail. Scientific journals and their users jointly create on social media fascinating information resources that are relevant, authoritative but nevertheless also entertaining.

In some cases, social media tools enable the reader contribution to act as information filters. Liking, recommending, commenting, tweeting or sharing links to articles may enhance their visibility and use. The tools, especially blogs, also contribute to professional and scientific knowledge.

According to Schroeder, Power, and Meyer (2011), the amount and diversity of Web 2.0 dissemination of research add complexity to evaluation of the impact of research. Coincidentally, the fields of evaluation research are developing into Scientometrics 2.0 (Priem & Hemminger, 2010; Schroeder et al., 2011) and altmetrics (Priem et al., 2011) – maybe also to Webometrics 2.0.

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.joi.2012.06.004.

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