186. Using Social Media to Spread Science and to Engage Readers in Conversation

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Abstract. In this paper, we examine "the top 20 Most Popular Science Websites" as established by eBizMBA (eBusiness Knowledgebase) in July 2010, based on three major traffic ranking websites. These top 20 websites includes magazines, blogs aggregators, a press release aggregator, research institutes, academic journals and so on. We aim to understand how popular science websites use the Web and its social features to communicate science and to engage the readers in conversation. We analyze these top 20 sites by focusing on how they display their information and use social media to interact with their readers. Moreover, we complete this study by analysing their behaviors on Twitter. Finally, we discuss our findings and how science websites spread information and stay connected with their readers.

Keywords: Media, Science news, Scientific communication, Social web, Twitter

Introduction

The Web 2.0 is interactive, real-time, and let everyone contribute. It eases the dissemination of information by allowing anyone to publish, share and comment content on the Web [9]. It thus provides a large amount of free-access information available online. However, this raises some issues on how to retrieve the relevant content and to give credibility and trustworthiness to a science website.

The Pew Internet Survey [4], conducted in USA, have found that 20% (40 millions) adults use the Web to get science news and information, while television remains the first source with 41% (newspapers and magazines get a score of 14%). However if they need to search for specific scientific information, then the Web is users' first source according to this survey: "The Internet is a research tool for 87% of online users (128 million adults)". However, more than a research tool, Web 2.0 allows also users to react to what they read. [3] wisely encourages users to be more active on the Web and to interact with journalists, experts and so on. He aims "to help people become active and informed users of media, as consumers and as creators". Indeed, we believe that letting readers to ask questions, to discuss with authors, experts, journalists, etc. are an important element of a democracy. Therefore, we were then interested in understanding how the most popular science websites use Web 2.0 features to provide their readers with opportunities to comment and share information.

In the next section, we review some of the current challenges for science writers and science websites. In Section 3, we present our methodology and describe the analysis of the top 20 science sites in Section 4. Subsequently, we examine how these websites use Twitter in Section 5. Finally, we conclude our paper in Section 6.

Motivation

A challenge for science writers

Being a science writer on the Web requires new skills in addition to the ability of writing well and communicate science facts. This include having multimedia competences [2] and being able to up to date information in real-time (as opposed to printed news that cannot be edited once they are published). Science writers now need to interact with their readership and adapt their process accordingly, while they were used to produce information and then let the audience passively consume it.

Web 2.0 not only challenges the profession; it also provides opportunities. For instance, the formatting of articles on the Web generally provides more space for science news, whilst this is a constraint in printed version [13]. However, since anybody can publish science news on Internet, science writers' profession is then truly affected and needs to redefine its mission and habits, if writers do not want to be bypassed [14] and still want to make a difference compared to others writers.

Indeed, scientific content produced by scientists themselves can be freely accessible [13] for any interested users. Moreover, as surveyed by [7], researchers try to directly address themselves to a broader audience in order to share their knowledge and expertise.

Furthermore the top 20 (see Table 1) shows the interest by the audience to such content, since it includes academics sites such as sciencedirect.com, an academic database. It also contains sites written by researchers for a broader audience such as scienceblogs.com. This is in our opinion an interesting aspect, as this kind of science website was not included in the classification provided by [13], which shows a fast and growing evolution of the online science news ecosystem. Indeed, as described in Section 3, this top 20 includes different types of sites, emphasising the variety of content and creators that one may find on the Web.

Credibility of online scientific content

We believe that the Web helps the dissemination of scientific messages. However it raises also many concerns about the difficulty for users to establish the value, credibility, reliability and trustworthiness of scientific information they browse [8] [12]. Indeed, this information available online can be created by anybody, making more difficult to differentiation between a site and another.

[11] studied the factors that influenced people about the credibility they give to a science website. They distinguished users with low involvement in science from users with high involvement. The three criteria used to judge the credibility of a science website are the domain, the popularity and the attractiveness. They found out that a website using the .gov extension (reserved to governmental sites) is perceived as more credible than a .com extension (that everyone can buy). Another study [8] concludes that information professionals - such as librarians - are key players to help users to retrieve valuable information and then enhance perception and awareness in science. The Pew Internet Survey [4] reveals also that 54% of online science consumers go to the original source of the information retrieved to check the reliability of the news. According to [11], the characteristic related to the completeness of the information and its verifiability is important for an audience highly involved in science.

Methodology

We analyzed the top 20 most popular science websites established by eBizMBA (eBusiness Knowledgebase) in July 2010 (See Table 1). Their ranking is based on the average of the three following traffic rank websites : Alexa, Compete and Quantcast. In order to figure out how sites display their content and use social media to interact with users, we manually read and analysed between 10 and 15 random news items from each science website, leading to a total of 253 news analysed . We selected articles from different categories such as “top stories”, “technology feature”,
“favorites”, “editor’s choice”, etc. We also studied the website’s blog, if any. We followed a similar process for each sites. We mainly observed (1) the general information displayed (author, date, contact), and (2) the social aspect it provides, such as comments, integration with Web 2.0 sites like Facebook and Twitter (we will describe these sides in section 4.2), etc.

Finally, we observed the Twitter account of these science websites (see Section 5). By studying the conversational patterns (such as replies) of these websites on Twitter we could establish why and for which purposes they use it, i.e. to interact with others or simply to spread information.

Table 1. Top 20 Most Popular Science Websites, July 2010.

	Science website	Unique visitors/month
1	howstuffworks.com	12,000,000
2	noaa.gov	10,000,000
3	discovery.com	9,400,000
4	nasa.gov	8,900,000
5	sciencedirect.com	4,500,000
6	sciencedaily.com	2,400,000
7	nature.com	1,800,000
8	treehugger.com	1,700,000
9	popsci.com	1,400,000
10	scienceblogs.com	1,250,000
11	physorg.com	1,200,000

12	newscientist.com	1,000,000
13	livescience.com	950,000
14	space.com	750,000
15	scientificamerican.com	700,000
16	redorbit.com	600,000
17	sciencemag.org	550,000
18	eurekalert.org	400,000
19	hubblesite.org	350,000
20	sciencenews.org	250,000

Dataset Discription

We identified two main characteristics in our dataset (see Table 1). The first aspect is the website's origin, i.e. whether it was directly a Website, or was created from a genuine media, such as a scientific newspaper or magazine. Five websites are the online version of a printed edition: popsci.com, newscientist.com, scientificamerican.com, sciencenews.org and nature.com. Nasa.gov, noaa.gov and hubblesite.org are websites of research institutes to communicate about research and outreach science and technology accordingly. Finally, discovery.com was first a TV channel. Interestingly we noticed the inverse phenomena for howstuffworks, the number one in our top 20 science websites (see Table. 1), which could get a TV version . The 11 other sites are educational website (howstuffworks. com), science blogs (treehugger.com, scienceblogs.com), science news (livescience.com, space.com, redorbit.com, sciencedaily.com, physorg), academic database (sciencedirect.com), academic journal (sciencemag.org) and press release aggregator (eurekalert.org).

The second aspect we identified is websites aiming to display sources such as academic papers or press releases. For instance, sciencedirect.com is a scientific database, nature.com is a scientific academic journal and eurekalert.org is a press release aggregator. Nasa.org and hubblesite.org also provide press release. Such a science websites included in the top 20 show a will from the audience to have access directly to sources usually used by science writers to report on findings.

Thus, the list of the top 20 science websites ranged from websites providing access to academic papers, to sites delivering press release, through news and stories outreaching findings and more generally science and technology.

Authorship

For a news item, displaying the name of an author in addition to his title and/or a brief biography might help the readers to give credibility, reliability and trustworthiness to the website. We thus checked that first characteristic and also looked at whether authors provide email address to be contacted by their readers.

80% of science news items that we studied were signed by authors, while 15% could not be specifically identified. For instance, some articles from space.com are signed "TechNewDaily Contributor" or "space.com staff". Physorg.com does not systematically sign their news, but the copyright is given at the end of the article such as "©2010AFP". 5% articles from our whole dataset are not signed at all. Moreover, 62% of the articles observed do not provide author's title or author's biography. For sites such as nasa.gov and hubblesite.org, this information might not be essential to give credibility to the news since the website itself is identified as credible according to [11]. In contrast, scienceblogs.com displays an author's biography on the left column of the website. Another criteria we looked at was the creation date of the article, helping to put a story into context. 98% of our dataset provides this information. Furthermore, we explored whether or not an email address was given. We made the difference between the ability to contact the site and the capacity at emailing an author specifically. In the latter case, only 22% of science news studied displayed such information. This information was given especially by sciencedirect.com, eurekalert.org, nasa.gov and scienceblogs.com. These websites, as described earlier, display either press release or publications; which imply to give contact information. News items posted on scienceblogs.com are mainly written by scientists, for whom such information may be a mean to discuss their research interest and increase their network.

Overall, we did not identified specific patterns that would allow us to make a difference between sites. Most of them display the authors' name with a tendency to not add his title / biography and a contact.

Analysing how they engage users in conversation

We then observed how readers can be engaged in conversation, by studying the comment section of news items

and their integration with social media services such as Facebook and Twitter.

About 30% of sites do not provide a comment section. They are mainly represented by nasa.gov, sciencedirect.com and eurekalert.org, which provide press release or academic publication. Therefore, as seen earlier, these sites do provide email but do not allow comments. Regarding the news allowing public comments, very few of them got reply by the article's author. We noticed that only scienceblogs.com made a visual distinction between author's comments and users' ones, which allows readers to solely follow author's comments if wished. Furthermore, we observed that the comments' number tend to be lower than the number of posts on Twitter, Facebook recommendations or bookmarks using Digg, when this data is available such as in Figure 1. Here, a news from sciencemag.org had only 3 public comments but 570 recommendations via Facebook and 136 links from Twitter. This may reveal a will by readers to engage conversation with their community using their Twitter or Facebook accounts.

Twitter, Facebook, personal email, Delicious and Digg are the five most popular way of sharing an article in our dataset. Delicious and Digg are two social services allowing to bookmark pages. Facebook is a social network service with more than 500 million active users and "more than 150 million people engage with Facebook on external websites every month" . Finally Twitter is a free social media service launched in 2006. In September 14, 2010, it had
160 million registered users with 90M tweets written per day . It allows users to spread update to their followers up to 140 characters. Anybody can follow users of their choice, which do not imply reciprocity.

Therefore, personal email implies predefined recipients while Facebook and Twitter are addressed to a larger community. However, Twitter is the only one with an open audience, which allows to achieve a wider diffusion and also offers the ability to engage authors or science websites with their readers, without the need to know or follow each other.

We also analysed whether these websites are present on such services or not. 11 have a Facebook account, 17 a Twitter account including 7 with a Twitter account but no Facebook one, while 3 do not have accounts on these services (sciencedirect.com, nature.com and sciencenews.org). However, in this paper, we will not discuss the strategy and motivation behind those websites to get an account or not.

The following section presents a analysis of how Twitter is used by these websites. Indeed, we believe Twitter has this potential to enhance conversation between experts, science writers and broader audience [7]. Moreover other surveys showed that 19% of Web users use status-update services, such as Twitter, to share and see updates online [5].

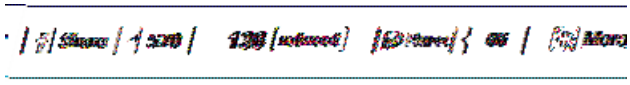

Figure 1. Comments versus Social Media (From http://tinyurl.com/298t46b, taken on 30 October)

Twitter analysis

To establish our dataset, we distinguished official accounts from other accounts using same usernames (but created by fans for instance). Therefore, we searched on websites' homepages whether or not they have a link to a Twitter account. By doing so, we could trust the provenance of a Twitter account. However, when no link was provided, we manually search on Twitter for such an account, looking if it was certified or not (see Figure 2.) We then analysed the Twitter feed of 16 websites (Table 2). This dataset does not include nature.com and sciencenews.com since they do not have a Twitter account, nor hubblesite.gov and space.com due to technical errors in our crawling methodology (described next). Moreover, while @usnoaagov, @sciencedirect, @sciencedaily, @scienceblogs and @ redorbit are not certified account, we kept them in our dataset.

During 4 consecutive days, we crawled (1) the Twitter feed of these 16 Twitter accounts, leading to a total of 1560 tweets (i.e. Twitter messages) and (2) all tweets containing a reply to any of these usernames (following the @ username pattern) (Table 2), leading to a total of 6932 replies. We then noticed a high tendency from users to engage with these science websites on Twitter. The following section describes in further details the results. In addition we manually noted the number of followers and followings of each Twitter account. Followers being users who follow the update of the Twitter account @user_A. Followings being users followed by @user_A. Then by following the classification suggested by [6], we established 15 of them are likely to belong to the media category (which is actually the case) since their number of followers is much more superior to the number of followings, while redorbit.com got a higher score of following versus followers.

Figure 2. Certification Twitter Account

Analyse of our twitter datasets

To analyse the tweets displayed by science websites and replies addressed to them, we studied the following conversational patterns containing into the original tweets: replies (@username) and hashtags. This latter is a commun practice that consists in using keywords in messages, marked as #tags. We also studied the retweets to see if they are a way to engage conversation [1]. “Structurally, retweeting is the Twitter-equivalent of email forwarding where users post messages originally posted by others” [1]. In addition, we also looked at the proportion of hyperlinks.

As shown in Table 2, most of the accounts largely include links into their tweets revealing a will to use Twitter to widely spread their news. While 7 accounts seem to use Twitter solely in that purpose, the others tend to add conversational patterns into their tweets, such as @discovery and @sciencedirect that get a high reply score. Also @discovery and @eurekalalertaaas tend to add tags into their tweets, which may help them to be reached by users outside their community who follow the tags. Finally @sciencemagazine, @treehugger and @discovery seem to retweet often.

Table 3 shows the conversational patterns used in replies addressed to these accounts. It shows a global tendency to get tweets addressed to science websites accounts, especially @nasa, @treegugger and @newscientist who get respectively 1478, 1033 and 781 distinct users interacting with them. Interestingly as described in Table 2, they are also part of the accounts that use conversational patterns. Therefore they are likely to use Twitter to engage users in conversation. We also have accounts such as @sciencedirect that only get 2 replies with zero retweet, while 85% of their orginal tweets contain a reply pattern. Yet, @popsci use Twitter to only spread links, but get a high score of retweet from 227 distinct users.

In conclusion, Twitter is mainly used by science websites to spread news via hyperlinks

Table 2. Analysis of the Conversational Patterns in their tweets

	#tag (%)	@user (%)		Link (%)	RT (%)
@howstuffworks	0	25		86	16
@usnoaagov	12.5	0		92	0
@discovery	42	70		62	23
@nasa	3.5		27.5	79	12
@sciencedaily	0	0		100	0
@sciencedirect	0	85		15	0
@treehugger	11	22		96	24
@popsci	0		0	100	0
@scienceblogs	0	0		91	0
@physorg_com	0	0		100	0
@newsientist	20.5	10		90.5	4
@livescience	0	0		61.5	0
@sciam	2	5		95	13
@redorbit	0	0			

100	0.5			
@sciencemagazine		11.5	3	94.5
25.5				
@eurekalertAAAS		25	72	100
16.5				

and to try to reach more users. These tweets are then well retweeted by users as shown in Table 3. Hashtags and replies are used by some science websites Twitter accounts. In the future, we will go further in the analysis to figure out the quality of the conversation and the profle of the users.

Conclusion

In this study of the top 20 science websites, we outlined the current tendency by users to visit websites not only written by science writers, but also sites that distribute sources such as academic papers and press release. Moreover, the presence in the top 20 of sciencebogs.com shows also the popularity of news written directly by researchers to a broader audience. Furthermore, readers seem to prefer engaging conversation using social media services where they have an account, rather than directly on the website. We also observed that the Twitter accounts of science websites are mainly used as a mean to reach more readers than to engage with users.

Finally, based on our result we believe that Twitter might be a relevant service to engage readers in conversations on scientific and technologic topics.

Table 3. Analysis of the patterns in messages addressed to science websites

	#tag (%)	Link (%)	RT (%)	Users (number)
@howstuffworks	42	42	53	158
@usnoaagov	46	63	63	102
@discovery	24	29	49	487
@nasa	16	55	38	1478
@sciencedaily	19	86	60	119
@sciencedirect	0	0	0	2
@treehugger	24	81	46	1033
@popsci	34	77	66	227
@scienceblogs	6	96	24	190
@physorg_com	14	63	69	294
@newsientist	30	56	70	781
@livescience	21	95	73	49
@sciam	19	67	65	437
@redorbit	8	67	40	19
@sciencemagazine	35	70	63	87
@eurekalertAAAS	20	70	81	19

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