

Social software: fun and games, or business tools?

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Abstract.

This is the era of social networking, collective intelligence, participation, collaborative creation, and borderless distribution. Every day we are bombarded with more publicity about collaborative environments, news feeds, blogs, wikis, podcasting, webcasting, folksonomies, social bookmarking, social citations, collaborative filtering, recommender systems, media sharing, massive multiplayer online games, virtual worlds, and mash-ups. This sort of anarchic environment appeals to the digital natives, but which of these so-called 'Web 2.0' technologies are going to have a real business impact? This paper addresses the impact that issues such as quality control, security, privacy and bandwidth may have on the implementation of social networking in hide-bound, large organizations.

Keywords: blogs; digital natives; folksonomies; internet; podcasts; second life; social bookmarking; social networking; social software; virtual worlds; Web 2.0; wikis

1. Introduction¹

Fifty years ago information was stored on punch cards. SDI services appeared about 10 years later and databases were available online from about 1978. In 1988 PCs were in common use and by 1998 the web was being used as a business tool. The web of the 1990s might be thought of as 'Web 1.0', for now in 2008 there is much hype about Web 2.0, but what does that mean? Web 2.0 is an umbrella term for a number of new internet services that are not necessarily closely related. Indeed, some people feel that Web 2.0 is not a valid overall title for these technologies. A reductionist view is that of a read-write web and lots of people using it. Tim O'Reilly and colleagues [1] introduced the term in 2004 and later produced a report refining the concept [2].

O'Reilly defines eight core patterns of Web 2.0:

1. Harnessing collective intelligence
2. Data as the next 'Intel Inside'
3. Innovation in assembly

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4. Rich user experiences
5. Software above the level of a single device
6. Perpetual beta
7. Leveraging [sic] the long tail
8. Lightweight software and business models and cost effective scalability.

He expands on these patterns as follows. Harnessing collective intelligence is sometimes described as *the* core pattern of Web 2.0; it describes *architectures of participation* [3] that embrace the effective use of network effects and feedback loops to create systems that get better the more that people use them. The second core pattern above is jargon for the fact that information has become as important as, or more important than software, since software itself has become a commodity.

The web, says O'Reilly, has become a massive source of small pieces of data and services, loosely joined, increasing the recombinant possibilities and unintended uses of systems and information. The web page has evolved to become far more than HTML markup and now embodies 'full software experiences' that enable interaction and immersion in innovative new ways. This relates also to pattern 5 above: software such as the horizontally federated 'blogosphere' (hundreds of blog platforms and aggregators) or the vertically integrated iTunes (server farm plus online store plus iTunes client plus iPods) are changing the software landscape. Indeed, the concept of a software 'release' is disappearing. Software is continuously changing: eBay, for example, deploys a new version of its service approximately every two weeks. Hence the phrase 'perpetual beta' that is commonly heard in connection with Web 2.0. The idea of the 'long tail' is that 80% of the internet's resources might be useful to only about 20% of users; Web 2.0 allows the mass servicing of micromarkets cost effectively. Finally, O'Reilly claims that lightweight software and new business models are changing the economics of online software development fundamentally, providing new players with powerful new weapons against established players and even entire industries.

Other parties have not been slow to capitalize upon the '2.0' brand: Web 2.0 has led to Library 2.0 [4, 5], Office 2.0 (backed by an annual conference in San Francisco), Enterprise 2.0 (with a conference in Boston) and probably other 'twos'. Andrew McAfee [6] defines Enterprise 2.0 (for getting the most out of Web 2.0 applications in the enterprise) using the acronym SLATES for some features that do not seem very different from those of Web 2.0:

- Search (information must be searchable)
- Linking (links must connect and cross-reference blog posts, wikis etc. into an interactive and interdependent community)
- Authoring (simple tools must be provided to allow everyone to contribute and edit content)
- Tagging (users must be able to assign their own terms and descriptions, which allows content to be structured in a way that is meaningful for users)
- Extensions (applications should include a suggestion and recommendation system such as that found on Amazon [7] or StumbleUpon [8] – 'if you liked X, you'll like Y')
- Signals (technology, such as RSS, that tells users when new content of interest appears).

The current article briefly outlines a number of Web 2.0 concepts, without discussing details of the technologies or software involved in implementing them. The strengths and weaknesses of specific IT companies, marketing issues, 'monetization' [9], and market economics [10] are also beyond the scope of this study. Some of the drawbacks of Web 2.0 technologies are discussed, but the main focus of the article is on Web 2.0 technology adoption in the publishing, chemical and pharmaceutical industries. The semantic web and Web 2.0 may be related in certain ways but the semantic web is outside the scope of this article.

2. Social software

Social software includes a large number of tools used for online communication, e.g. instant messaging, text chat, internet fora, weblogs (or blogs for short), wikis, social network services, social guides, social bookmarking, social citations, social libraries and virtual worlds. These are discussed in more detail in the sections that immediately follow this one. Most of us are familiar with applications such as instant messaging (e.g. MSN Messenger, Yahoo Messenger, AOL Instant Messenger, Skype), text chat (e.g. Internet Relay Chat, IRC), internet fora, blogs and wikis. Skype [11] is a well-known example of the use of Voice-over-Internet protocol (VoIP). In 2005 Skype was bought by eBay for \$2.6 billion, a price that many analysts now consider excessive. By 2007 as many as 220 million people had registered with Skype. A study by Ofcom in the UK [12] in September 2007 found that 17% of adults with broadband have used Skype or the Tesco VoIP service at least once. In the UK only 14% of those who said that they were users professed to use these services every day, but penetration is 27% of households in France and the Netherlands.

2.1. Wikis

One of the best known wikis is Wikipedia [13]. As of September 2007 it boasted 8.2 million articles in 253 languages. It is one of the 10 most visited sites on the web. Specialized Wikipedia projects also exist. A Wikipedia WikiProject in chemistry [14], for example, strives to incorporate the collaborative efforts of those with interests within chemistry and related areas into the articles and therefore improve the overall quality of the Wikipedia.

Much has been written about the possible inaccuracy of an encyclopaedia multi-authored by anonymous and perhaps unreliable 'experts' but proponents argue that there are so many people reading and editing Wikipedia that errors should be edited out sooner rather than later. This is an example of the concept of 'wisdom of crowds' [15], a term introduced by James Surowiecki to describe the aggregation of information in groups, resulting in decisions that, he argues, are often better than could have been made by any single member of the group.

2.2. Blogs and feeds

Blogs are now in such common use that engines (e.g. Google blogsearch [16] and Technorati [17]) have been developed specifically to search them. Most of us are also familiar with web feeds such as RSS and Atom. RSS (Really Simple Syndication or Rich Site Summary) is a family of web feed formats used to publish frequently updated content such as blog entries, news headlines or podcasts. An RSS document, which is called a 'feed', 'web feed' or 'channel', contains either a summary of content from an associated web site or the full text. The name Atom applies to a pair of related standards. The Atom Syndication Format is an XML language used for web feeds, while the Atom Publishing Protocol (APP or 'AtomPub') is a simple HTTP-based protocol for creating and updating web resources.

A podcast is a digital media file, or a series of such files, that is distributed over the internet using syndication feeds for playback on portable media players and personal computers. The term 'podcast' is a portmanteau of the words 'iPod' and 'broadcast'. A podcast is distinguished from other digital media formats by its ability to be syndicated, subscribed to, and downloaded automatically when new content is added, using an aggregator or feed reader capable of reading feed formats such as RSS or Atom. (It seemed appropriate to use the definitions of all these terms given in Wikipedia [13].)

Social networking tools such as blogs, wikis and podcasts are becoming very popular in academia [18]; one expert claims that the most popular platform for viewing lectures at the University of California, Berkeley will soon be by podcast [19]. The American Chemical Society (ACS) has a digital presence on YouTube [20] where viewers can watch videos from the most recent ACS National Meeting and video clips originally released as part of press releases [21].

2.3. Social networks and guides

User-generated content and virtual communities [22] are not new phenomena. Virtual communities have been used since the 1980s. The ChemWeb.com community in the 1990s had virtual lectures and discussion groups but the technology of the time was not capable of supporting the visionary features it wanted to offer [23]. A number of cultural factors were also involved in its decline. The discussion groups were never well used; even in the 2000s chemists in industry are reluctant to broadcast their views openly.

With Web 2.0 the community's contributions are foremost: the site exists only to create and serve those contributions; the result of user-generated content is 'collective intelligence'. YouTube [20] would not exist without the videos contributed by community members. YouTube is not just a site where teenagers share shots of interest only to a minority; in 2007 the world at large learned of the protests by monks in Burma because dissidents were able to broadcast videos through services such as YouTube. YouTube is just one of very many social network services. Another well-known example is Flickr (for sharing photographs) [24].

Social guides such as WikiTravel [25] and TripAdvisor [26] cater for specific interests, in this case travel. WikiTravel is a project to create a free, complete, up-to-date and reliable worldwide travel guide (with the appearance on screen of Wikipedia). TripAdvisor carries over 10 million reviews and opinions of hotels, vacations etc. supplied by travellers. The various Web 2.0 applications do not operate in isolation. They can be joined together in 'mash-ups', web applications that combine data and/or functionality from more than one source. A mash-up example is TripAdvisor maps, which combines the TripAdvisor hotel popularity index and Google maps. Mash-ups are a newer content aggregation technology than 'portals'. A web portal (e.g. Yahoo) is a site that provides a single function through a web page or site.

Facebook [27] and MySpace [28] are hugely popular consumer networking sites. Facebook claims that it has 66 million active users (as of March 2008) with about 250,000 new registrations every day since January 2007. Facebook advertises such statistics on its web site. MySpace figures are more elusive: the press office supplies them by telephone to accredited representatives of the media. In January MySpace apparently claimed more than 110 million monthly active users worldwide, with on average 300,000 new people signing up every day [29]; the UK press office told this author in March 2008 that there are nearly 110 million users worldwide. Even though such social networking sites are ostensibly for consumers, they have been used by universities and commercial employers to check up on the activities of students or the validity of *curricula vitae*.

Social networks such as LinkedIn [30], Ryze [31] and XING [32] for business and professional use are also growing in popularity. In March 2008 LinkedIn claimed more than 19 million registered users, up from 14 million in August 2007. It is a contact network with user profiles and recommendations. Users are connected by direct connections, second degree connections (i.e. the contacts of one of your primary contacts are your own secondary contacts) and third degree connections. This author's 202 connections (February 2008) supposedly link her to more than 684,900 professionals.

LinkedIn is used to find jobs, people, and business opportunities. Employers can list jobs and seek employees; job seekers can view profiles of hirers and get introduced. The 'gated access' approach is used in the hope of ensuring that users only accept contacts whom they trust and would recommend. Newer services are the 'LinkedIn Answers' service (members broadcast questions and hope that experts will provide useful answers), groups, and news ('discover articles that your colleagues are reading'). New services will doubtless continue to be added.

One of the problems with social networks is that it might be necessary to belong to more than one in order to communicate with all one's friends. Presumably some people are registered with both MySpace and with Facebook, and find time to participate actively in both communities, but this author currently has no intention of indulging in multiple professional networks.

A quick look at Alexa [33] reveals the most popular (most visited) web sites (listed below). The names of the top 10 sites are unchanged on 4 March 2008 compared with 7 October 2007, but their precise rankings differ. Alexa computes traffic rankings by analysing the web usage of millions of

Alexa Toolbar users. Other free rankings services survey fewer users or are biased by country or type of site, according to a quick check in March 2008, but they confirm that Google and Yahoo are in the top three, that YouTube is in the top five, that msn.com is in the top six and that MySpace is in the top nine.

The most popular web sites on 7 October 2007, according to Alexa, were:

1. Yahoo.com
2. Google.com
3. MSN.com
4. YouTube.com
5. Live.com
6. MySpace.com
7. Orkut.com
8. Facebook.com
9. Wikipedia.com
10. Hi5.com

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1. Yahoo.com
2. YouTube.com
3. Live.com
4. Google.com
5. MySpace.com
6. MSN.com
7. Facebook.com
8. Hi5.com
9. Wikipedia.com
10. Orkut.com

2.4. Social bookmarking

Social bookmarking sites [34,35], such as del.icio.us [36] and furl [37] allow people to share bookmarks for internet pages, assigning keywords ('tags') of their own choice to describe the sites that have appealed to them. Bookmark lists organized by tag, date, owner, etc. can be communicated using RSS feeds. 'Tag clouds' draw sites into clusters and tagging is used to create an informal taxonomy dubbed a 'folksonomy'. (The term 'folksonomy' is attributed to Thomas vander Wal [38] by anecdote and by Wikipedia.)

Standard knowledge management systems, information portals, intranets and workflow applications are usually highly structured (and thus somewhat inflexible) from the start [6]. Users have little opportunity to influence the structure. Wikis and blogs, however, start as blank pages, and the highly flexible folksonomies start to grow as users enter tags. A discussion of the advantages and disadvantages of taxonomies and folksonomies [39] is beyond the scope of this article.

Sites such as Digg [40] and Reddit [41] are, strictly speaking, methods for social news distribution rather than social networking sites. They use the same sharing, tagging and voting technologies as social networking sites but they apply them to news stories rather than web pages per se [34]. The popularity of such facilities is in no doubt. One expert reports: 'Just two years ago social book-marking was a new animal. Today it's folksonomy and it's studied in graduate school.' [19].

Tagging is also used in a more 'academic' way in freely accessible sites such as CiteULike [42], Connotea [43, 44], and BibSonomy [45]. Problems he encountered in his own research led Richard Cameron to create the free service CiteULike which enables the sharing and discovery of links to scholarly literature. CiteULike aims to make it easier for groups of researchers to communicate and collaborate online and it is offered in multiple languages. Connotea was conceived by Nature Publishing Group in 2004, on seeing the possibilities offered by del.icio.us. BibSonomy is offered by the Knowledge and Data Engineering Group of the University of Kassel, Germany; it is available in both German and English versions.

2.5. *Virtual worlds*

At the other extreme, perhaps, from the basic and practical uses of Web 2.0 are virtual worlds such as massively multiplayer online (role-playing) games: MMO(RP)Gs such as World of Warcraft [46] and non-game worlds such as Second Life [47], and The Sims [48]. Second Life is an internet-based virtual world launched in 2003, developed by Linden Lab. A downloadable client program called the Second Life Viewer enables its users, called 'residents', to interact with each other through motional avatars. Residents (more than 20 million are registered) can explore, meet other residents, socialize, participate in individual and group activities, and create and trade items (virtual property) and services from one another. This virtual world even has its own economy and its own currency. The Sims is a strategic life-simulation computer game created by Will Wright, published by Maxis, and distributed by Electronic Arts. It is a simulation of the daily activities of one or more virtual characters ('Sims') in a suburban household near SimCity.

Those who think that virtual worlds are esoteric and impractical for industrial and academic pursuits might consider this statement by an analyst [49]: 'By the end of 2011, 80 percent of active internet users (and Fortune 500 enterprises) will have a "second life", but not necessarily in Second Life [...] enterprise clients [...] should investigate and experiment [...] but limit substantial financial investments until the environments stabilize and mature.'

As well as for entertainment, Second Life has been used by business (e.g. Adidas, Dell, Calvin Klein, Warner Brothers, Nature and Harvey Nash), universities (e.g. the Open University, Ohio University, Harvard Law School, and Princeton University), cultural organizations (e.g. Virtual Rome, Louvre, and the Alliance of Second Life Librarians), politicians (e.g. Hillary Clinton, John Edwards, and Antonio di Pietro), banks (e.g. ING, Saxo, and ABN Amro) and even by countries (Sweden, for example, has an embassy on Second Life).

Some specific usage examples are discussed later, but a few related to the above users are worth mentioning here. Harvey Nash has a job board in Second Life. Princeton University's island includes a conference area, a museum of the arts, a performance hall, and an information centre. There are several places designed for teaching and learning. A wilderness and activity area and a science museum are planned for the future. Roma is a virtual Rome re-creation and Second Louvre Museum is a Second Life video. Antonio di Pietro, founder of Italy's Italia de Valori party and Italy's Minister of Infrastructure conducted a live press conference in Second Life in July 2007 with leading members of the Italian press to discuss and demonstrate the power of Second Life as a tool for political and social organizing. John Edwards was the first presidential candidate to have an official second life and Hillary Clinton and Barack Obama have campaign headquarters in the virtual world. Saxo uses Second Life to build its company culture across different offices around the world. It also has a basement in Second Life where employees can play a game of pool and it designed its new, real-world headquarters in Copenhagen in Second Life. It has also created an interface in the virtual world allowing investors to win Second Life currency (Linden dollars) and try trading.

3. Statistics

The world of Web 2.0 is fast changing and a lot can happen in just six months. The well publicized studies outlined in this section are a snapshot of 2006–2007 Web 2.0 usage and they are likely to have been out of date even when the current article was prepared late in 2007.

Booz Allen Hamilton [50] interviewed 2400 consumers in the UK, Germany and the USA between August and October 2006 about their attitude to Web 2.0, and what it offers in the broad sense, and about their actual user behaviour. The survey found that 41% of internet users in the UK use Web 2.0 sites to interact and participate with others in a massive worldwide community of users, and Web 2.0 usage is prevalent across all age groups and both sexes. Users share information without privacy concerns and rely on recommendations from anonymous peers. Although newer sites still have predominantly young user communities (50% of MySpace users are under the age of 25), a significant proportion (24%) fall into the older 35–49 age bracket. The more established the site, the more balanced the age group using it: 25% of Amazon users are over the age of 50.

Two contradictory studies of Web 2.0 business usage were published in 2007. On 20 March 2007, Forrester released some results from a December 2006 survey [51] of 119 chief information officers (CIOs) at mid-size and larger companies. It indicated that Web 2.0 is being broadly and rapidly brought into enterprises: 89% of the CIOs said they had adopted at least one of six prominent Web 2.0 tools, blogs, wikis, podcasts, RSS, social networking, and content tagging, and 35% said they were already using all six of the tools. Although Forrester did not break down the adoption rates by tool, it did say that CIOs saw relatively high business value in RSS, wikis, and tagging and relatively low value in social networking and blogging.

On 22 March 2007 McKinsey released the results of a broader survey of Web 2.0 adoption [52], and the results are quite different. In January 2007 McKinsey surveyed 2847 executives (not just CIOs) from around the world. The survey found strong interest in many Web 2.0 technologies but much less widespread adoption. McKinsey looked at six Web 2.0 tools: blogs, wikis, podcasts, RSS, social networking, and mash-ups. (It did not include tagging.) It found that social networking was actually the most popular tool, with 19% of companies having invested in it, followed by podcasts (17%), blogs (16%), RSS (14%), wikis (13%), and mash-ups (4%). After adding in companies planning to invest in the tools, the percentages are as follows: social networking (37%), RSS (35%), podcasts (35%), wikis (33%), blogs (32%), and mash-ups (21%). It seems that American companies may not be the leaders in embracing Web 2.0 in coming years. Leading the way are Indian firms, 80% of which plan to increase their investments in Web 2.0 over the next three years, compared with 69% of Asia-Pacific firms, 65% of European firms, 64% of Chinese firms, 64% of North American firms, and 62% of Latin American firms.

Why do the McKinsey numbers differ from those of Forrester? Perhaps it is all a question of whom you ask: anecdotal evidence shows that top management and workers at the coal face have very different perspectives on which technologies are actually in use in an organization. In some organizations management bans the use of social networking sites. For example, in an exchange of views on the UK Electronic Information Group (UKEIG) listserv [53], someone from English Heritage said that English Heritage does not allow use of Facebook while someone else (Phil Bradley) pointed out that there is a Facebook group for English Heritage staff, albeit with only 14 members at that time.

In June 2007, Forrester [54] studied the reaction of 275 IT decision makers to the term 'Web 2.0': 44% reacted positively, 20% were strongly positive, 29% were neutral, 3% reacted negatively and 3% had never heard of Web 2.0, but, significantly, out of 268 familiar with Web 2.0, 53% were somewhat concerned, and 25% were very concerned, about the risks of employee-driven, unsanctioned use of Web 2.0 technologies. This leads us on to consider some of the negative aspects of Web 2.0.

4. Issues

The problem of malicious or inappropriate use is not confined to new *internet* technologies (junk mail comes through the letterbox and the fax machine, for example) but the misuse of Web 2.0 could lead to many problems, which do need consideration:

- spam, spim, spit, skam, splog
- breach of security
- breach of privacy
- clogging of bandwidth
- leak of company secrets
- lack of control (by management or by community rules)
- the need to set rules
- fear of 'shadow IT'
- user addiction
- waste of employees' time
- virtual crime

Web 2.0 leads to new types of spam including 'spim', 'spit', 'skam', and 'splog'. 'Spim' is spam sent to a mobile phone or by instant messenger. 'Skam' covers spam such as reception of strange messages from total strangers in Skype. 'Spit' is spam over mobile telephony in general. A 'splog' is a spam blog. Neologisms are not the only feature of verbal communication in the age of the digital native (someone born in the internet era or just before); 'If U Cn Rd Ths' you will be familiar with the impact of mobile telephony on usage of written English.

At least one highly visible example of a breach of security has been reported [55]. In September 2007, a Microsoft staffer by the name of Jason Langridge posted an entry to his blog that detailed an upgrade to the Windows Mobile operating system, and he included a link to a page where the upgrade could be downloaded. Unfortunately for his employer, the upgrade, Windows Mobile 6.1 (to solve an incompatibility issue that left Windows Mobile 6.0 users unable to read Office 2007 file formats) was not supposed to be made publicly available for at least two more weeks.

This is just one of the sorts of risk that IT departments fear. They are suspicious of intellectual property leaks, of silos of information, and of users operating their own insecure servers. They fear 'shadow IT': unlicensed copies of software are unearthed or some system breaks and IT staff discover hardware or software in the organization that they did not know existed. Some large organizations have banned instant messaging and social sites not just on the grounds of security but also because they can consume vast amounts of bandwidth. Control is a debatable issue. Corporate wikis are not free-for-alls: they have rules. Wikipedia is now 'controlled', although there are those who object to censorship by anonymous experts, who do not advertise a fair procedure for appeals. Corporate wikis, behind a firewall, are said to be most effective when the number of users is small and the content is focused.

This author was sent a private e-mail message by a pharmaceutical industry researcher who wishes to remain anonymous, in which he revealed the message that his company displayed when he tried to access Gerry McKiernan's entries on Facebook [56]:

The following URL is blocked by [Company X] policy because of its content categorization by our subscription service: 'Social Networking' <http://iastate.facebook.com/group.php?gid=3D5055907636>. Please read [Company X] Web Content Filter Policy for more information. If you feel there is a valid business reason to access this site, please submit the Web Content Filter Override Request Form which will be reviewed by appropriate management. Exception requests may require approval from a Vice-President or above.

He remarked that he had little hope getting an exception approved: the firewall in the same company used to block the translation function in Google and it took months to get the decision reversed.

In a discussion on the UKeIG listserv [53], Phil Bradley stated 'If you can't trust your staff to use resources sensibly perhaps you shouldn't let them have computers. A technical support

department should ensure that they understand what the issues are and how to deal with them rather than attempt a blanket policy of hiding behind the word “no”. Another subscriber to the list replied that students spend an increasingly disproportionate amount of time poking and writing on walls, to which Bradley replied that in his student days he used to spend too much time playing pool. Euan Semple [57, and quoted in 58] feels that these arguments will eventually become a recruitment issue as the digital natives refuse jobs at organizations that will not allow staff to keep up with their online networks. How would you feel if your employer took away your cell phone or BlackBerry?

A virtual crime is a virtual criminal act that takes place in a massively multiplayer online game, and as such is beyond the scope of this article. South Korea, a country where such games are extremely popular, has a special police investigation unit for virtual crimes.

5. Adoption

5.1. *Information professionals*

Information professionals were early adopters of Web 2.0 technologies [4, 59, 60]. In June 2007 LexisNexis announced the results of a nationwide survey [61] showing that 39% of information professionals access blogs at least weekly and 34% access wikis. Video or audio podcasts were used less: 16% access video podcasts and 15% audio podcasts.

The pros and cons of email, listservers, blogs, wikis and social networks have doubtless been discussed on many listservers popular with information professionals; this author can cite examples from UKeIG and an even more specialized group, the chemical information listserver, *chminf-l* [62]. The large number of messages appearing on *chminf-l* and the UKeIG list about Gerry McKiernan's activities on Facebook [56] have provoked lively discussion. When key workers leave an organization, their 'email' does not leave with them if it is on a blog or wiki. The newer systems also allow for extensive commenting, recommending and tagging. Despite all that, many information professionals still use email (and the *chminf-l* list) much more than they use Web 2.0 social software.

The UK National Archives organization has a wiki, called Your Archives [63], with the look and feel of Wikipedia. Facebook has a Library 2.0 interest group and a UKeIG group. The Chartered Institute of Library and Information Professionals (CILIP) has held virtual meetings in Second Life and it held a virtual seminar in connection with the Umbrella meeting in 2007 through Second Life [64].

There is more than one library 'in-world' in Second Life. The Alliance Library System of Illinois has a library project in which a number of librarians from all over the world are taking second lives and jobs in Second Life [65]. The 'residents' apparently appreciate having an in-world access to these library services and materials. Another Second Life library project has a blog [66] located on the InfoIsland.

Library of Congress is funding preservation of Second Life material [67, 68]. Through its National Digital Information Infrastructure and Preservation Program (NDIIPP), it has eight partnerships as part of its new Preserving Creative America initiative to address the long-term preservation of creative content in digital form. These partners will target preservation issues across a broad range of creative works, including digital photographs, cartoons, motion pictures, sound recordings and even video games. The work will be conducted by a combination of industry trade associations, private sector companies and not-for-profit organizations, and cultural heritage institutions. One of these projects includes Second Life.

One of the Library of Congress partners, the University of Illinois at Urbana-Champaign [68], has launched a Preserving Virtual Worlds project to explore methods for preserving digital games and interactive fiction. Major activities will include developing basic standards for metadata and content representation and conducting a series of archiving case studies for early video games, electronic literature and Second Life. Second Life content participants include Life to the Second Power, Democracy Island and the International Spaceflight Museum. Partners are the University of Maryland, Stanford University, Rochester Institute of Technology, and Linden Lab.

The Department of Information Studies, University of Sheffield has launched the Centre for Information Literacy with Sheila Webber as Director. The centre has offices on the Eduserv island in Second Life. Webber herself has a Second Life blog, 'Adventures of Yoshikawa' [69].

5.2. Publishers

Publishers have also embraced Web 2.0. *USA Today* has reportedly switched on all the social functionality of Facebook and MySpace. *The Economist* now publishes almost all its letters online, using a blog content management system enabled for comments. Nature Publishing Group has three islands on Second Life, dubbed 'Second Nature' [70, 71]. Nature Network [70–72] is designed as a professional toolkit for scientists and has been described as 'somewhere between Facebook and LinkedIn'.

Some recently launched learned publications now offer collaborative features. *ACS Chemical Biology*, for example, has a wiki, podcasts and 'Ask the Expert'; *ACS Nano* has a free online resource, ACS Nanotation, that enables nanoscientists to save time by reading reviews that identify the most significant new research [73]. In addition, researchers can get answers to their questions from top scientists. Other tools available to registered users include a wiki and multimedia networking opportunities. Members can upload photos to the image gallery and share videos at NanoTube, and enjoy free podcasts.

Elsevier has launched 2collab [74], a free web application that provides researchers with a platform to share resources with networks of peers and specialists in an online community. It allows researchers to add, share and rate bookmarks, tag resources, and to add comments and create topical groups. Each user is encouraged to create a personal profile, which everyone can view to ensure the authenticity of fellow users. Elsevier's Scirus Topic Pages (still in a beta-test version) [75] is a free, wiki-like service for the scientific community, where scientific experts summarize specific scientific topics, and where links to the latest, most relevant journal literature and web sources are presented on one page.

5.3. Pharmaceutical and chemical industries

A Forrester survey [76] has indicated that 71% of CIOs are more interested in Web 2.0 technologies if they are offered as a 'suite'; 91% of those using the six Web 2.0 technologies (blogs, wikis, podcasts, RSS, social networking, and content tagging) prefer suites. Large vendors, such as Microsoft, IBM and Oracle, are preferred over smaller, 'pure play' firms such as Socialtext, NewsGator and MindTouch. Typical suites are Microsoft Office SharePoint Server ('SharePoint'), SuiteTwo from Intel and IBM Lotus Connections. Such applications promote the notion of 'software as a service' (SaaS). When it comes to SaaS, CIOs look at the smaller vendors and ask if they will be in business in two to three years' time, whereas they see IBM as having a lot of stability.

SharePoint is a competitor to classical enterprise content management programs such as FileNet, Documentum and Open Text. SuiteTwo currently offers wiki, blog, RSS and portal technology. Phase two release may include podcasting, social networking, VoIP and instant messaging. IBM Lotus Connections includes software for blogs and bookmarking (in a program called Dogear), plus Activities, a user-friendly repository for groups to share and collaborate on a project. This last option, a departure from more complex, traditional document management systems, is used by the Federal Aviation Administration where it is claimed that IBM's tools are very collaborative and give the end-users more control over how they communicate with their colleagues, but these tools are on-site, and server-based behind the firewall. Here the *intranet* rather than the internet is harnessed as the platform. For businesses, Web 2.0 often becomes entwined with service-oriented architectures and other web services technologies.

The pharmaceutical and chemical industries are using Web 2.0 technologies behind firewalls but most have said little about this in public. Some AstraZeneca scientists have used Documentum eRoom as a secure, web-based workspace for efficient collaboration among distributed workers. Pfizer's Research Information Factory, and the use of wikis, blogs, tagging and Pfizerpedia [77] were described at a recent conference [78].

Whether you believe that pharmaceutical companies use Web 2.0 extensively depends (as with all surveys) on whom exactly you ask. A colleague of this author, at another pharmaceutical company, allows this comment to be printed anonymously:

There are pockets of wiki-madness inside our research group, much of it well thought out and perhaps even useful, albeit nascent and little-used and poorly advertised, but the environment and IT infrastructure is not terribly supportive, even if the current senior management is. One idea was to use a wiki to host a gene/target annotation system, so anyone and everyone could provide material on their favourite genes, pathways and systems, connect it somehow to well curated reference databases, and use the wiki concept to capture proprietary and personal additions.

Another anonymous comment is as follows. 'We've started to use SharePoint to establish a group-wide "MySite" dialogue, blog and "social site" for our internal chemistry colleagues [...] it has the look and feel of some of the web's social sites, just internalized and supportive of proprietary Q&A.'

Martin Leach of Merck & Co. allowed his comments to be attributed in *Chemical & Engineering News* [79]:

drug industry IT is trending toward highly configurable architectures that employ web-based search functions such as the semantic web and open-source programs like wikis.

Workers at three different chemical companies have also shared anonymous comments with this author. At one company SharePoint is proving popular, while management encourages standard knowledge management systems because they have security, records retention policies etc., but wikis are growing up everywhere as adjuncts. One colleague says that wikis are seen as a 'sexier' way of doing the help and support functions around their major knowledge management system. SharePoint is glossier and more professional but wikis are nice and simple to use. Wikis are used in help files at one company. Another colleague reports that the situation is not necessarily that wikis are frowned upon; in some cases management cannot see why anyone should need a wiki if a 'proper' tool is available.

6. The future

Will hide-bound, large organizations be able to prevent social software from creeping in through the back door? Probably not. One courageous approach has been taken by the computer company Dell. It launched IdeaStorm, a Digg-like [40] community-driven web site. Users can submit ideas and product improvements, and vote them up or down. Dell thus risks having customer complaints exposed in public but the company claims that it has actually had success with customer suggestions. As the Deloitte Touche analyst John Hagel, cited in [80], has said: 'Remember that the water-cooler conversations are going to happen whether you listen or not. The only choice you have is whether you will participate.' Of course, web sites of the type 'CompanyXSucks.com' were quite common even before the days of Web 2.0, but they were not interactive.

Blanket bans on social computing can be small-minded and may not prevail. Employers need to have some trust in the people they choose to employ. In the past they did not resort to banning telephones in case employees made private calls. It is, however, not unusual for companies to maintain procedures for monitoring access to pornography, gambling and other facilities on the web, and for preventing improper use of email, and most people would agree that an organization needs some guidelines about the use of social computing in the workplace. There are good arguments on both sides. It is likely that a happy medium can be achieved, as seems to have happened at Pfizer. Given the reluctance of pharmaceutical companies to reveal details of tools that might give them a competitive edge, management must have approved the public exposure given to Pfizerpedia and the like [77, 78].

Although some of the mistakes made with public virtual communities and e-commerce in the 1990s may well be repeated (e.g. users unwilling to share information, too many companies trying to take a share of the pie, unrealistic expectations, and erroneous estimates of usage and advertising revenues), after some experimentation, efficient tools behind the firewall will be

established. The really useful technologies will rise to the top. People will eventually distinguish hype from practicality. It is also certain that there will be consolidation and among the many, many pure play companies (as happened with the virtual communities and e-commerce sites); some will not survive but the best will flourish. LinkedIn, for example, looks as if it is approaching the productivity phase.

Forrester Research [81] concludes that social computing has radically changed the way people interact with both information and one another on the internet, giving people the ability to generate, self-publish, and find information more efficiently, and share expertise in an approach that is much easier and cheaper than that of earlier knowledge management systems. Web 2.0 will not go away, however much IT and legal departments might wish that it would. The analysts advise, however, that before implementing Web 2.0 technologies, potential users must balance the risks (in reliability, security, governance, compliance, and privacy) against the opportunities Web 2.0 represents. They also suggest that lessons learned from earlier instant messaging deployments might be relevant in evaluating Web 2.0.

As with many expensive surveys and studies, the conclusions of the Forrester report seem fairly obvious. What is not so clear is where we are on the 'S-curve' and how long it will be before the use of Web 2.0 technologies in business is routine and the next wave of disruptive technology is getting daily exposure in the press. Some people are already using the term Web 3.0, usually without any clear definitions or strategy. No doubt, in about five years' time something new on the web will be making an impact, whether it be Web 3.0, the semantic web, or something completely different.

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