EMBO reports

viewpoint

Scientific discourse 2.0

Will your next poster session be in Second Life®?

Stephen T. Huang, Maged N. Kamel Boulos & Robert P. Dellavalle

The expanding technologies of the Internet, telecommunications and computing have led to increasingly sophisticated and diverse methods of communication during the past decade. From simple text-based chat rooms to online virtual worlds, these new technologies present novel ways to interact with one's peers and the public. The Internet is not only influencing and changing the business model and format of traditional scientific publishing (Smith, 2006), but also informal communications among scientists.

Web 2.0 applications have become so pervasive that many Internet users have utilized the technology without specifically seeking to do so

Tim O'Reilly, the founder of O'Reilly Media (Cambridge, MA, USA), coined the term Web 2.0 to describe this trend towards user-oriented content, whereby online information is provided and edited by communities of individual users. The data are fluid and can be changed in Web 2.0 applications, as opposed to the static, platform-based Web 1.0 format in which online content was browsed passively with little or no user contribution (O'Reilly, 2005). Examples of popular Web 2.0 websites and databases include: Wikipedia, an online encyclopaedia; Flickr, a photograph database; YouTube, a site for sharing amateur and professional videos; PatientsLikeMe, a patient-driven database of experience with treatment and medication testimonials; and social networking websites such as Friendster, Facebook and MySpace. These applications provide a framework in which users can upload, share and remix large amounts of information (Wheeler & Kamel Boulos, 2007); people with varying levels of experience can easily add their own writing, pictures or other files to be made available for review and consumption. The ability for every individual to become a 'publisher' in his or her own right has become such an accepted part of popular culture that, in 2006, *Time* magazine declared its Person of the Year to be "You", in reference to the introduction and evolution of Web 2.0 applications and their swift acceptance at the start of the century (Grossman, 2006).

Successful Web 2.0 applications provide easily searchable information through simple, intuitive interfaces. Part of the appeal of Web 2.0 is the ability to easily access files and information of personal interest. Web 2.0 applications have become so pervasive that many Internet users have utilized the technology without specifically seeking to do so. The website Amazon.com, a popular online merchant, gives its users the ability to review and comment on the products they are selling. General participation guidelines allow for a broad expression of opinion through reviews, discussion forums and the creation of personal favourite product lists. Using the shared knowledge and comments of other users to supplement one's own online shopping experience is an example of the application of the Web 2.0 ideology, which taps into the so-called 'collective intelligence' or the 'wisdom of the crowd' (Kamel Boulos & Wheeler, 2007). However, Web 2.0 communities are also sometimes seen to exemplify Pareto's Principle—also known as the 80/20 rule—whereby 20% or less of the users contribute 80% of the content. The other 80% of users, known as 'lurkers', simply visit and experience the community passively. In reality, 20% might even be a far too generous assessment; by using Wikipedia as an example, an analysis revealed that in 2005, 0.7% of its users—524 people—contributed more than 50% of the content (Swartz, 2006).

Another trend that has developed along with user-driven Internet applications is the emergence of and increasing participation in online three-dimensional (3D) virtual worlds known as 'metaverses'. These are simulated spaces with which users interact through graphical representations of themselves known as 'avatars', which can generally be modified to reflect an individual's personality and creative expression. Since online worlds first appeared, the increasingly powerful graphical abilities of modern computers have made them, and the avatars that inhabit them, much more realistic. Popular online worlds include multiplayer role-playing video games such as World of Warcraft (Blizzard Entertainment; Irvine, CA, USA) and virtual metaverses that allow their users to socialize, communicate with each other and build their own content, such as Second Life® (Linden Lab; San Francisco, CA, USA). Despite being 'virtual', 3D worlds host counterparts of real-life businesses and organizations such as Nature Publishing Group (London, UK), The Coca-Cola Company (Atlanta, GA, USA) and NASA (Washington, DC, USA). In addition, virtual money earned in Second Life® can be exchanged for real US dollars through Linden Lab, and users can modify the avatar environment to produce saleable goods, express themselves, create and programme virtual objects, upload intricate files, pictures and sounds, and allow other users to interact with and experience their information in new ways—a concept that draws from self-publishing and user creation in the spirit of Web 2.0. In fact, 3D virtual worlds comprise part of a much

larger development: the next-generation 3D Internet (Kamel Boulos & Burden, 2007; IBM, 2007).

Scientists have shown interest and initiative by using these programmes as platforms to achieve diverse goals. Second Life® provides a space in which scientists interested in the freedom of discourse have held meetings to discuss the use of the Internet for medical education and the exchange of ideas. Following on their heels, scientific publishers such as Nature Publishing Group have used their virtual 'real estate' in Second Life® to offer scientists access to the literature, databases, discussion forums and other applications. The Wiley publication group (Hoboken, NJ, USA) has opened a virtual bookstore on Second Life® and has published many online guides to becoming an entrepreneur within the online universe (Wickert, 2007).

So far, virtual realms within Second Life® have been created for a range of purposes, including general public health education, museums, interactive educational displays and even to simulate sensory effects that reproduce the effects of neurological disorders (Kamel Boulos *et al*, 2007a; Luo, 2007; Yellowlees & Cook, 2006). Clinical applications in Second Life® include an innovative form of group and personal therapy that uses the online world as a safe training environment for patients with social anxiety disorders and with autistic spectrum disorders, including Asperger syndrome (Biever, 2007; Brady, 2008). Patients can interact through their avatars in simulated social settings without fearing negative consequences in the real world. Clinicians are considering how virtual worlds and the avatar experience can be used as a counselling tool (Gorini *et al*, 2007).

By providing shared spaces where individuals can meet nearly instantaneously…virtual universes could be used to host meetings without their participants attending in person

Another important application of 3D virtual worlds is the creation of 3D visualizations, simulations and 'virtual patients' that can be used to train medical students. The US National Institutes of Health (Bethesda, MD, USA) is creating an online world—based on the On-Line Interactive Virtual Environment (OLIVE) platform (Forterra; San Mateo, CA, USA; Kushner, 2008)—to test the response of industrial workers to emergency disasters. The Interactive Trauma Trainer (TruSim; Leamington Spa, UK) is another example of a 3D world application used to train physicians and medical students.

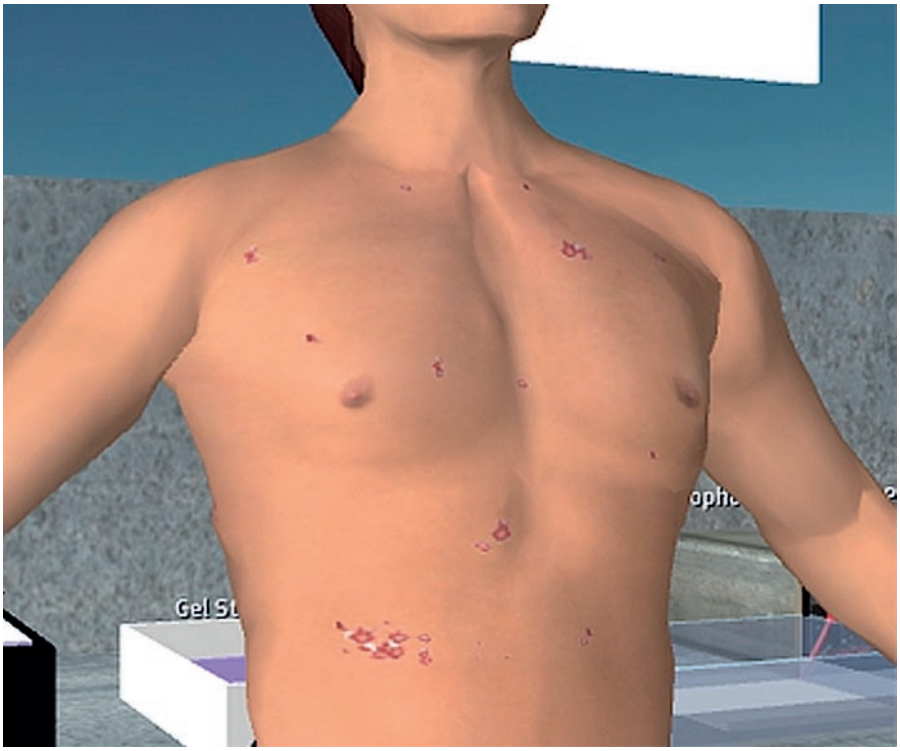

Fig 1 | An avatar wearing the 'AIDS-related Kaposi Sarcoma Experience' skin in Second Life® using Adobe Photoshop and similar tools. The skin shown in this picture was created by Second Life®: Bailey Yifu.

Maged Kamel Boulos and colleagues have developed an 'AIDS-related Kaposi Sarcoma Experience' skin as part of their 'Sexual Health SIM' project in Second Life®, where users, through their avatars, are able to see and experience how Kaposi sarcoma looks and feels to AIDS patients (Fig 1; http://sl-sexualhealth.org.uk/). The same principle can be expanded, refined and used to role-play patients with various skin conditions and presentations at different stages of a disease to show how progress, worsening or healing might appear. Such 'virtual patients', controlled by real humans at their PCs, can also be used to train clinicians—especially about rare conditions—and for teaching undergraduate students. This virtual clinical experience provides trainees and clinicians with the opportunity to ask virtual patients questions about their disease history, to obtain intelligent answers from the patients in real time by using voice or text or both, to conduct clinical examinations, ask for further tests or investigations, receive feedback, and access additional sensorial inputs such as streaming audio, video, photographs and text, as well as links to web pages and other resources. This can help to show the progress of a treatment; depending on a trainee's questions and prescriptions, the person role-playing the patient can switch to the appropriate skin, so that the trainee doctor is able to see the effect of his or her diagnosis and treatment.

The question is whether there is sufficient interest within the scientific and medical communities to use online universes to apply a Web 2.0 approach to discuss scientific issues or, more generally, to enhance communication among researchers. Virtual worlds provide unique tools for communication, including the ability to interact through avatars, the possibility to create and modify objects and simulated spaces, and allowing many users to converge on one location without having to physically relocate. By providing shared spaces where individuals can meet

nearly instantaneously—despite being separated by large distances in the real world—virtual universes could be used to host meetings without their participants attending in person. A great deal of time that is normally spent in transit, arranging accommodation and adapting to finding oneself in a new place, could be saved if participants only needed to connect to their avatars, type several commands and be transported directly to the virtual conference site (Lester, 2007). Such a meeting also has the advantage of being environmentally friendly as it reduces the energy required to transport people to a meeting.

…interactions between scientists and other professionals in an online universe could instigate collaborations in the real world…

Moreover, 3D virtual worlds offer more sophisticated avatars that are able to express emotions and pseudo-body language, and a shared pseudo-physical 3D space that allows students and tutors to feel more naturally 'close' because of the shared spatial dimension—as opposed to a two-dimensional conference call, chat room or phone call (Kamel Boulos *et al*, 2007b).

The ability to modify online worlds and to create customized objects and virtual rooms could have a positive impact on the presentation of data and information. Traditional poster sessions, for example, only present research findings in a static format with the investigator standing next to the poster to answer questions. Similar poster presentations within virtual worlds such as Second Life® could not only effectively simulate the spacing, timing and methods of presentation sessions, but also allow the expansion and modification of the conference space as needed. In addition, users would be able to add information to and edit their posters based on other participants' questions and feedback, and interact with other avatars in a similar manner to real life. Poster presenters would not even have to be online for the whole event in order to answer queries because they could use a mobile phone as an effective bridge between the virtual and real worlds (Kelly, 2007). Furthermore, entire sessions could be saved and the virtual space preserved for future perusal by attendees and those who were absent.

The ability to easily expand virtual spaces and to invite many users from different backgrounds to a virtual conference could be a major improvement to scientific discourse (McConaghy, 2007). Scientists and scholars from various fields, who might not attend similar, formal conferences in reality because they cannot justify the expense in terms of money and time, might be more willing to visit an online meeting outside their speciality. A virtual online meeting would also benefit the organizers: hosting additional attendees would not increase the overall costs, and invitations could be sent out informally and easily to any interested individual from beyond the usual professional circle. Both the scientific discourse and progress would be likely to benefit from the input of such people with a different background because they could provide new viewpoints. Furthermore, interactions between scientists and other professionals in an online universe could instigate collaborations in the real world to explore and investigate new approaches to address existing questions. Virtual 3D worlds are well suited for collaborative applications and are increasingly being used in this way, for example, as virtual emergency public health situation rooms to train personnel in the effective management of emergencies and disasters in real time (Kamel Boulos & Burden, 2007).

Conferences can occur in physical and virtual worlds simultaneously, as audiences of both worlds are able to see each other, communicate and interact. The UN Conference on Climate Change, which took place between 3 and 14 December 2007 in Bali and in Second Life®, was one such attempt to link both worlds, and succeeded in drawing a larger and wider audience (Samson, 2007).

Although this might sound like a rather optimistic look into the future of scientific debate, there are real and unique problems that still hold back the efficient use of Web 2.0 technologies for scientific discourse. The technology is still not at a level that allows simple, easy and global access. Successfully displaying and running a virtual world on one's computer requires a significant amount of computing power, including a powerful graphics card. As a newcomer, navigating and adapting in these worlds can be a steep learning curve and present a frustrating obstruction (Sanchez, 2007). As popular and useful as Web 2.0 applications are, a tool that appears dauntingly complicated could risk losing many potential users. Accessibility is also dependent on the ability of each user to actually connect to the Internet at high-speed, which is not guaranteed everywhere in the world, and is often constrained by fees and local network availability. Furthermore, as corporations and universities install access control programmes (Business Wire, 2002) to limit or block potentially distracting programmes and video games, it can become impossible or difficult to connect to Second Life® from shared computers. Obtaining access to an online realm's servers from a given network might require negotiation with departments in charge of Internet access at individual institutions, which consumes both time and effort.

Without proper authorship information and review processes, it could become impossible to separate useful, valid data from well-presented opinion or falsehoods

Although there are concerns about malicious users purposefully interfering with meetings or defacing or manipulating realms by altering or creating objects, Second Life® does have options that can provide additional security. These include banning or ejecting known offenders and other editable preferences. Technical problems and service crashes might also present a problem if users are unable to access their avatars; however, this unpredictable problem is prevalent in any actively developing technology.

Another issue that could curtail the usefulness of Web 2.0 applications is the credibility of information, which is provided and edited by the users, many of whom have their own particular interests and agendas. Even Wikipedia's founder cautions users on the absolute accuracy of its information (Young, 2006). The lack of clear and complete authorship and editorship information attached to a Web 2.0 entry, including authors' affiliations and credentials, is a serious quality concern (Kamel Boulos *et al*, 2006). As anyone can contribute to these sites and publish their own documents and files, information also carries the danger of being biased and misleading (Keelan *et al*, 2007). Scientists might

not be comfortable using such information compared with traditionally peer-reviewed literature. Jaron Lanier, a computer scientist at the University of California Berkeley (Berkeley, CA, USA), and one of the early proponents of virtual realities, actually warns against the hazards of Web 2.0 collectivism or what he calls 'digital Maoism' (Lanier, 2006). Without proper authorship information and review processes, it could become impossible to separate useful, valid data from well-presented opinion or falsehoods. In this respect, Google Knols might be a step towards at least a partial solution to this problem because it requires proper highlighting of the authors of each piece of information (Schrock, 2008).

Certainly, peer-reviewed literature and scientific meetings in the physical world will remain the main modes of distributing scientific information and informal communication. Yet, communication through virtual-world technology might become a useful supplement to the traditional discourse. The particular strengths of this technology include: its potential to share, review and comment on information, both with the public and one's peers; options that allow users to create and develop unique objects, and presentations to educate and inform others and to display data; and, last but not least, the time and cost of bringing people together within and across disciplines can be reduced.

As with any new technology, there are issues that could have an impact on the usefulness of online communication and its acceptance within the scientific community. Scientists who rely on peer-reviewed data for their work might find Web 2.0's lack of proofreading unacceptable to document research findings. However, we should explore the existing and potential applications of virtual communication for unique ways to discuss ideas, answer questions, educate and debate. Our ability to understand what we can accomplish in online worlds depends on our collective experience with the technology. The more scientists and clinicians who work with and comprehend the applications of virtual worlds for their respective research fields, the sooner we will realize how this technology can be best applied. The next step is to invite ourselves into these online realms, experiment with what they have to offer, and see where our exploration and creativity takes us.

ACKNOWLEDGEMENTS

This study resulted from Colorado Health Informatics Collaboration interdisciplinary discourse supported by academic enrichment funds from the University of Colorado Denver, School of Medicine. We thank Scott Freeman and Clayton Green at the University of Colorado in Denver, USA, and Christopher Scott Lassiter of Roanoke College, in Salem, USA, for their comments and input. Linden, Linden Lab and Second Life® are trademarks of Linden Research, Inc.

REFERENCES

Biever C (2007) Web removes social barriers for those with autism. *New Sci* **2610:** 26–27

Brady J (2008) How 'Second Life' Therapy Helps Asperger's Patients. Dallas, TX, USA: WFAA, January 11th. www.wfaa.com

Business Wire (2002) Corporate networks become employee playgrounds as growth, complexity of online games skyrockets, cautions Websense Inc. *Business Wire*, May 29th

Gorini A, Gaggioli A, Riva G (2007) Virtual worlds, real healing. *Science* **318:** 1549

Grossman L (2006) Time's Person of the Year: You. *Time*, December 13th

IBM (2007) *Five Innovations That Will Change the Way We Live Over the Next Five Years*. Armonk, NY, USA: IBM. www.ibm.com

Kamel Boulos MN, Burden D (2007) Web GIS in practice V: 3-D interactive and real-time mapping in Second Life. *Int J Health Geogr* **6:** 51

Kamel Boulos MN, Wheeler S (2007) The emerging Web 2.0 social software: an enabling suite of sociable technologies in health and health care education. *Health Info Libr J* **24:** 2–23

Kamel Boulos MN, Maramba I, Wheeler S (2006) Wikis, blogs and podcasts: a new generation of Web-based tools for virtual collaborative clinical practice and education. *BMC Med Educ* **6:** 41

Kamel Boulos MN, Hetherington L, Wheeler S (2007a) Second Life: an overview of the potential of 3-D virtual worlds in medical and health education. *Health Info Libr J* **24:** 233–245

Kamel Boulos MN, Wheeler S, Toth-Cohen S (2007b) Designing for learning in 3-D virtual worlds: the University of Plymouth Sexual Health SIM experience in Second Life. In *Proceedings of IADIS International Conference on Cognition and Exploratory Learning in Digital Age (CELDA 2007), 7–9 December 2007, Algarve, Portugal*, X Kinshuk, DG Sampson, JM Spector, P Isaías (eds), pp 401–406. Lisbon, Portugal: IADIS

Keelan J, Pavri-Garcia V, Tomlinson G, Wilson K (2007) YouTube as a source of information on immunization: a content analysis. *JAMA* **298:** 2482–2484

Kelly S (2007) *Click. Mobile Talk Moves to Web 2.0*. London, UK: BBC, February 23rd. http://news.bbc.co.uk

Kushner D (2008) Winner: make your very own virtual world with OLIVE. *IEEE Spectrum* **January**

Lanier J (2006) Digital Maoism: The Hazards of the New Online Collectivism. *Edge*, May 30th. www.edge.org

Lester B (2007) Sustainable science: greening the meeting. *Science* **318:** 36–38

Luo JS (2007) Virtual reality therapy: on your desktop today. *Prim Psychiatry* **14:** 20–22

McConaghy T (2007) Using Second Life for Knowledge Transfer and Collaboration. Presentation at the International Workshop on Managing Knowledge for Space Missions. CalTech, July 17th–19th. www.nasa.gov

O'Reilly, T (2005) What is Web 2.0. www.oreillynet.com

Samson T (2007) Eco group brings climate-change conference to Second Life. *InfoWorld* **6:** December. www.infoworld.com

Sanchez J (2007) Breaking the Second Life high Learning curve. *Educause Connect*, November 5th. http://connect.educause.edu

Schrock A (2008) Google's Answer to Wikipedia—Google's Knol project aims to make online information easier to find and more authoritative. *MIT Technol Rev*, January 15th. www.technologyreview.com

Smith R (2006) The trouble with medical journals. *J R Soc Med 2006* **99:** 115–119

Swartz A (2006) Who writes Wikipedia? www.aaronsw.com

Wheeler S, Kamel Boulos MN (2007) Mashing, burning, mixing and the destructive creativity of Web 2.0: applications for medical education. *RECIIS—Electronic Journal of Communication, Information and Innovation in Health* **1:** 27–33

Wickert JB (2007) Joe Wickert's Publishing 2020 Blog: Second Life Author Event. http://jwikert.typepad.com/

Yellowlees PM, Cook JN (2006) Education about hallucinations using an internet virtual reality system: a qualitative survey. *Acad Psychiatry* **30:** 534–539

Young JR (2006) Wikipedia Founder Discourages Academic Use of His Creation. *The Chronicle of Higher Education*, June 12th. http://chronicle.com

Stephen T. Huang (top left) is at Northwestern University's Feinberg School of Medicine in Chicago, Illinois, USA; Maged N. Kamel Boulos (top right) is at the University of Plymouth, UK; Robert P. Dellavalle is at the Denver Veteran's Affairs Medical Center and the University of Colorado Denver, Denver, Colorado, USA.
E-mail: robert.dellavalle@uchsc.edu

doi:10.1038/embor.2008.86