ARTICLE

Pacifying Cyberspace in the Age of the Zettabyte

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Abstract

The growth of the World Wide Web, and the revolution in information and communications technology of which it is a part, is an event of global historic significance, equivalent to the changes brought about by the industrial and agricultural revolutions of the 18th and 19th centuries. We are now living in a knowledge-based world in which the Internet is the core technological driver for knowledge storage, exchange and to a significant extent knowledge analysis and creation. The web is also a contested space, meaning that the values and ideas it generates and transmits are not neutral but have significant impact on how we live our lives. New forms of militarisation (cyberwar) and exploitation (cybercrime) are enabled by web technology and it can be argued that these darker aspects are in danger of becoming a dominating characteristic. This article explores the ways in which the web can be used to enhance capacities for creative peacebuilding through new forms of cyberpeace, which complement and extend the range of the traditional modes of conflict resolution while putting human agency – the choices and decisions of people – at the centre of the project to generate a global peace culture.

Keywords

conflict resolution, cyber conflict, cyber peace

INTRODUCTION

"Suppose all the information stored on computers everywhere were linked, I thought. Suppose I could programme my computer to create a space in which anything could be linked to anything. All the bits of information in every computer at CERN, and on the planet, would be available to me and anyone else. There would be a single global information space." (Berners-Lee, 2000, p. 4).

These words were written by Tim Berners Lee to explain the hopes he had at the point when he 'invented' the World Wide Web (www), following his paper outlining the concept in 1989 and his design of the first world wide website, in December 1990. Since 1990 the www has grown at an exponential rate. Cisco Systems, the California-based corporation that designs and manufactures web-based networking technologies, has estimated that data carried across the web globally by the end of the twentieth century, merely one decade after the invention of the web, was about 12 exabytes of human-produced information and communications media. To try to explain what this means, an exabyte is 1,000 petabytes, which in turn is 1,000 terabytes, and one terabyte is 1,000 gigabytes. Expressed more concretely, one exabyte can hold 36,000 years of HD video. In the projection of Cisco and other monitors of web growth, the www will pass another huge marker of expansion when, by 2015-2016, it will be measured not in exabytes but in zettabytes. A zettabyte is about 1,000 exabytes, and we are about to enter what Cisco analysts

have termed 'the dawn of the Zettabyte era'. In 2009, the whole of the www was estimated to have reached 500 exabytes, or one half of a zettabyte. By 2013 it had grown again to contain 4 zettabytes of data (Cisco Systems, 2013; The Guardian, 2011). These figures provide a measure of the capacity to store data, or information, technologically and electronically. To put this into perspective, the UNDP has pointed out that, in the year 2012 alone, humans generated more data than over the course of their entire history. (Mancini, 2013, p. iii). In addition to the capacity to store data, there has been a corresponding, though somewhat slower, revolution in the power to disseminate or broadcast it. The capacity to broadcast information stood at nearly two zettabytes in 2009. If we compare 'old' print media with new electronic media, this is the equivalent of every person on the planet receiving 174 newspapers every day of the year (Hilbert and López, 2011).

This rate of growth and the processing and dissemination capacity of information and communications technologies, (characterised by laptops, tablets, mobile phones, social media, crowdsourcing, crisis mapping, blogging, and big data analytics, web-based open access data and web-learning platforms and so on) is truly an epic shift or revolution equivalent to, or greater than, the industrial revolution of the 19th century and the agricultural revolution before, in its speed, range and global impact. But the shift also presents a challenge which is as much concerned with values, ethics, morals and epistemology as it is with disembodied science and technology.

In this paper in particular, the key question is, can the era of the zettabyte www be harnessed for the purposes of conflict analysis and peacemaking? The Internet is *inherently* neither a weapon of war, nor a tool or resource for peace. Although its origins as an operational electronic communications system lay in military R and D programmes and needs in the period of the Cold War, the ideals and values of some of its key innovators were centred around human needs and aspirations and international, global and cosmopolitan values. Berners Lee, as we have seen, envisaged that the www would form a single global information space. Peace and conflict researchers have also envisaged peacemaking as operating in four spaces. In a holistic definition, Galtung argued that the basic concern of research and action for peace is the reduction of violence of all kinds. Violence is the result of the denial of four basic areas of human need: survival, welfare, freedom, and identity. The relationships which produce peace or violence are formed in four spaces: personal relationships (the human space); the social space of societal constructions (broadly, culture, politics, economy); the global space of world systems (broadly, international politics), and ecological space (the relationship of people to the planet or to nature). He also refers to these as Nature, Human, Social and World spaces (Galtung, 1985; 1996, p. 193). However, the spaces in which peace and conflict research should work, as seen

by foundation theorists such as Johan Galtung in the 1950s and 1960s, did not anticipate the fifth spatial dimension that is cyberspace, the interconnected global space identified by Berners Lee. It is vitally important that this space becomes an integral component of peacemaking theory and practice.

Research on peace and conflict resolution has clearly evolved significantly since the core ideas and concepts were elaborated by the pioneers of the field in the late 1950s, when it first became institutionalised in university centres. For example, Lewis Fry Richardson's research data on conflict causes and patterns was rediscovered in the early 1960s, stored on microfiche. But the opportunity to engage with and utilise the full power of the web for the resolution of conflict still lags behind the efforts of those who are using it rather to conduct and intensify conflict. This paper provides an overview and some examples of how the web can be conflict resolution 'friendly', and how better understanding and uses of cyberpeace can advance the real world cause of non-violent conflict transformation (Karatzogianni, 2006; Halpin et. al, 2006).

THE MILITARISATION OF CYBERSPACE: CYBERWAR AND CYBERCONFLICT

It has been a concern, throughout the modern era, that new scientific and technological knowledge has frequently been appropriated to advance the military power of states and also the lethality and efficiency of military systems. In the early twenty-first century, the same phenomenon seems to be about to repeat itself, as the massive processing capacity of new information and communication technologies is applied to the revolution in military affairs (RMA), where precision guided and automated weapons systems pose the threat of an era of automated war. The impetus for this shift in the concept of warfare came in part from the dramatic military superiority of US forces in the first Gulf War against Iraq in 1991 and the war in Kosovo in March 1999. What were regarded as conventionally strong enemies were defeated by a 21st century American military with overwhelming superiority in satellite, communications and weapons technology, with zero or very limited battle losses of soldiers or equipment to the US and allied forces. What Michael Ignatieff termed *virtual war* had become a reality (Ignatieff, 2000). Warfare and conflict have entered the domain of what is now labelled cybernetics and cyberspace.

The mathematician Norbert Wiener developed the concept of cybernetics in the late 1940s, drawing on game theory and general systems theory. Wiener's concern was to research the science of the human and electronic interface.

His work on this was published in 1948 as *Cybernetics, with the subtitle control and communication in the animal and the machine*, and this inspired those pioneers who later went on to develop the concepts of cybernetics in the virtual electronic world of the Internet, when it was invented as the ARPANET in 1969. In what is now a well-known story, the pioneers of the Internet were funded through the US Defence/Advanced Research Project Agency (DARPA) in a strategic response by the Eisenhower administration to the threat of Soviet leadership of the space race and the perceived danger posed from their nuclear weapons systems. The remit of DARPA researchers was to ensure that the communications infrastructure of the US would survive any nuclear or space-launched attack. The resulting decentralised, 'survivable' computer network became the Internet and, in a later phase of evolution, which we consider below in relation to its potential as a medium for peace, the world wide web (Wiener, 1948; Naughton, 1999; Nayar, 2004).

In the past ten years, new terminologies for conflict conducted through the Internet, such as netwars and cyberwars, have been used to describe the impact of the revolution on conflict and conflict dynamics. Karatzogianni has defined and analysed these new forms of conflict generically as cyberconflicts, and there is a whole sub-set of associated terms, such as cyberattacks, cyberwar, cyberterrorism, cyberwarriors, cybersecurity, and so on. Cyberconflicts have already been fought on the Internet in disputes between Russia and Georgia, and between Russia and Estonia, using cyberattacks to compromise an opponent's computer and communications network. In 2009, a computer worm called Stuxnet attacked computers used in Iran's nuclear programme, causing the centrifuges used in the programme to malfunction and setting Iran's nuclear programme back by four years. Experts believe that the worm was developed as part of a CNA (computer network attack) by the USA and Israel (O'Connell, 2012).

Analysts and experts are now so concerned about the militarisation of cyberspace that they are beginning to predict that cyberspace will become the next 'warzone', and by 2009-2010 Rex Hughes showed how the USA, the UK, India, China, Russia and South Korea had begun to form command and control (C2) systems for military action in cyberspace, while a range of non-state actors, from Al-Qaida to the Zapatistas, are well established there. In recognition of the potential level of threat, Hughes has argued for a Treaty for Cyberspace to control and regulate interstate cyber conflict (Hughes, 2010; Parker, 2009). Since 2004, there has also been a Cyber Conflict Studies Association,[1] which has research programmes focused on, for example, the impact and use of cyber conflict methods by transnational actors, including the questions of how the variety of transstate actors (jihadists, anarchists, political activists, criminal organizations, etc.) will differ in their approaches to the possibilities of cyberwar, and how cyberwarfare might influence approaches to peacekeeping and peacemaking.

PACIFYING CYBERSPACE: FROM CYBERWAR TO CYBERPEACE

Following a period of association with the philosopher, mathematician and pacifist Bertrand Russell, Wiener became increasingly concerned with the ethics of scientific research and the potential of cybernetics to advance the human uses of scientific discovery. For Wiener, cybernetics was to secure "the human use of human beings", not to enslave humans to technology (Wiener, 1950, reprinted 1988). The power of the Internet as a force for enabling human progress and social change was also an explicit concern of the inventor of the www, Tim Berners Lee. As a physicist working in the CERN laboratory in Switzerland at the end of the 1980s, he developed the web as a massive enhancement of the ease of use and the interactive power and creativity of Internet computing. His ability and knowledge as a scientist, combined with his decision not to exploit his revolutionary innovation for commercial gain, but to make it freely available as a public good, placed Berners Lee firmly in the tradition of those who saw the positive transformative and emancipatory power of the Internet and the web.

True to the principles of its inventor, there has been an explosion of activity and innovation around humanitarian, cultural and peace-related projects. Although still in the very early stages of development, the social networking site Facebook has a Peace on Facebook area that measures friendships and connections made by members across national, religious and ethnic divides, and polls members daily on attitudes to achieve peace. Other sites such as openDemocracy.net provide intensive coverage of global issues around security, peacebuilding and democracy. The Conflict Information Consortium at the University of Colorado has an extensive web-based resource with gateways to eight key programme specialised areas: Beyond Intractability on complex conflicts; CRInfo on tractable conflict; CETR on conflict education and training systems; Conflict Frontiers; How to Stop the Fighting; Online Courses; Cultures of Peace, and a Civil Rights Mediation Oral History Project. The Consortium has "pioneered efforts to use rapidly advancing information technologies to provide people from all walks of life with the information that they need in order to deal with conflicts more constructively."

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[1] http://www.cyberconflict.org/

The web is transforming not only technologies and knowledge but the process of learning itself. The components of a virtual international peace university are still in a very early stage of development, but there are innovative centres, which may come to form the core drivers of such an initiative. A notable example is the Open University of Catalonia (Universitat Oberta de Catalunya – UOC) in Barcelona, which is an e-university, offering a variety of courses in peace, conflict resolution, humanitarian and development studies online.

With this level of activity and excitement about the potential of the World Wide Web to facilitate peacemaking in various ways, there is a sense of optimism and confidence that the transformative impact of the www is only in its early stages. And presents an unparalleled opportunity and challenge for conflict resolution globally, especially amongst younger people who are growing up to be web-literate and who are aware of its power.

The web has the potential for the kind of transformation its idealists hope for, but the world of cyberspace also replicates and in some senses may accentuate the power disparities and exclusions of the non-cyber world of politics and economics. The 'digital divide' is well recognised and acknowledged as a solid barrier to participation in knowledge sharing and knowledge creation that forms the core of the transformation project aspired to by Berners Lee and the web-idealists. Indeed, some critics go further than complaints about exclusion, and interpret the expansion of the information revolution via ICT as a new form of colonialism. For example, Castells has written about a Fourth World composed not only of regions such as sub-Saharan Africa, and parts of South America and Asia, but also of the ghettos in many cities of the developed North, where 'information capitalism' has "oppressed, stigmatised, criminalised, sick and illiterate persons" excluded from the knowledge and benefits of the digital revolution. The virtual world of cyberspace is, therefore, contested and conflictual, in much the same way as the 'real' world, but the challenges are the same in the sense that the emancipatory agendas of conflict resolution apply to cyberpeace-making as to conventional peacemaking.

There are encouraging signs that a capacity for global networking around transformative, cosmopolitan and global cyberpeace projects is emerging, to engage creatively with the challenges of using cyberspace resources to enhance real world peacemaking. This is true especially in the areas of conflict data gathering and analysis, and in the uses of real time GIS (geographical information system) and mobile networking to support civil society conflict prevention and peacemaking in conflict areas. In the second part of this paper we look at case studies and examples of each of these in turn.

i) Peace and conflict data storage and analysis

One of the main aspirations of the founders of conflict research was to collect comprehensive data about global conflict in terms of its location, duration and intensity, and from this to move on to a capacity to analyse and compute the data so as to understand causation and conflict prevention better. This data now exists. Perhaps the best known is the Uppsala Conflict Data Program,[2] but there were, in total, over 60 major datasets, identified in a paper by Kristine Eck, available in 2005, with a commentary on how to use them in peace and conflict research. Eck clearly defines the purpose and value of the conflict data for policy makers. Systematically collected conflict data provides lists of ongoing conflicts and it also provides the material to analyse the data for trends and patterns, which in turn is helpful in framing policy, for example for early warning and preventive action – as foreseen in the original 1957 issue of the *Journal of Conflict Resolution* (Eck, 2005).

While the main preoccupation in this data gathering has been to store and analyse information related to conflict, more recent work has built on this by examining not so much what causes conflict as what sustains peace. The following examples are pertinent here. The first is the dataset on conflict and peacebuilding produced by the Escola de Cultura de Pau (ECP), based at the Autonomous University in Barcelona. The methodology aims to include the counting, recording and tracking of peacebuilding and humanitarian activity, such as the status of peace negotiations, the work of the UN Peacebuilding Commission, the existence of arms embargoes, the status of demobilisation, disarmament and re-integration (DDR) processes, and the presence of the UN and other military and civilian peace missions. Its Observatorio de Conflictos y Construcción de Paz (Observatory for Conflicts and Peacebuilding) can be consulted on its web page.[3]

The second database is the Global Peace Index (GPI), produced by the Institute for Economics and Peace. The GPI first appeared in 2006 and was an attempt to develop a methodology which combined qualitative and quantitative indicators in order to measure both the negative and positive dimensions of Galtung's definition of peace. The objective of the project is to provide data for "estimating the value of peace to the world economy, and uncovering the social structures and social attitudes that are at the core of peaceful societies." Using a mixture of 23 quantitative and qualitative indicators, the GPI produces a peace index or ranking of 144 countries. In what amounts to probably the most comprehensive of any current database on peace

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2   http://www.pcr.uu.se/research/UCDP/
3   http://escolapau.uab.cat/index.php?lang=es

and conflict, the indicators are grouped into three broad categories to measure not only conflict levels but also wider processes of democratic openness, social security and well-being, and militarisation. These indicators are in turn linked to quantitatively-measured, potential 'drivers' of peace, such as: levels of democracy and transparency; international openness; demographics; education; culture and material well-being. The intention is to use the GPI to strengthen the political economy and culture of peace by enabling governments "to increase the peacefulness of their nations" (findings and methodology are described fully on its web page[4] for the years 2006-2013).

The third set of examples provides a comprehensive database of knowledge on how peace agreements are constructed and how violent conflicts can be transformed non-violently, in the form of the Peace Accords Matrix at the University of Notre Dame[5] and the Nonviolent and Violent Campaigns and Outcomes (NAVCO) Data Project at the University of Denver,[6] which compares the effectiveness of violent with nonviolent campaigns.

These are only a small sample of what is now available to policy makers, peacemakers, peacekeepers, NGO activists, journalists, educators and researchers, in a way which was unimaginable twenty years ago. Peace researchers are now building by accessing the complex knowledge sources already available in the commercial, military and natural science research communities. In our second example of emerging sophistication of cyberpeace-making, we examine the way in which new information technologies are being used in conflict prevention and early warning.

ii) New information technology and the prevention of violent conflict

In a very recent study, Stephen Livingston surveyed the emergence of what he has referred to as "digitally enabled collective action" for conflict prevention. The technological basis for this lies in the interconnected capacity provided by mobile phones, GIS platforms, and GPS (geographic positioning satellites). Livingston quotes estimates that, at the time of writing in 2014, there were seven billion mobile phones in use globally, with a variety of over 20 billion devices connected to the Internet (the so called *Internet of Things*). While the populations in the north have the most connectivity, the fastest growing rate of mobile telephony is in Africa, Asia and Latin America. This connectivity

has transformed the politics of peacemaking and conflict prevention in these areas, enabling and mobilising what Livingston has called "digitally enabled collective action" (Livingston, in press, 2014).

In Africa the most well-known and one of the most effective initiatives of this kind is the USHAHIDI Platform, which developed its approach to crisis mapping, using crowdsourcing methods, in Kenya following electoral violence there in 2007. Since then the method has been developed as an open source tool to enable people to design their own early warning and crisis mapping systems around the world. The USHAHIDI system is still in its infancy but, with its real-time data gathering, it promises to provide more power and speed of analysis and response than static systems such as the paper-based mapping tools previously available to conflict researchers, and even than the datasets outlined in the section above. USHAHIDI, which means *testimony* in Swahili, is a website that was initially developed to map reports of violence in Kenya after the post-election fallout at the beginning of 2008. USHAHIDI's roots are in the collaboration of Kenyan citizens as journalists during a time of crisis. The website was used to map incidents of violence and peace efforts throughout the country, based on reports submitted via the web and mobile phones. This initial deployment of USHAHIDI had 45,000 users in Kenya, and was the catalyst for realizing that there was a need for a platform based on it, which could be used by others around the world.

By May 2008, USHAHIDI had shared their code with a group in South Africa[7] that used it to map incidents of xenophobic violence. By August 2008, funding from Humanity United[8] enabled USHAHIDI to rebuild the platform, and by October 2008 the alpha version of USHAHIDI was completed and deployed in the DR Congo for testing. This version was tested and deployed with 11 different organizations directly, including the International Center for Transitional Justice (ICTJ), Peace Heroes,[9] and the Kenyan National Commission on Human Rights. Externally, there were four major alpha deployments, including Al Jazeera during the War in Gaza, Vote Report India[10] (to monitor the recent local elections) and Pak Voices (to map incidents of violence in Pakistan). The goal is to create a platform that any person or organization can use to set up their own way to collect and visualize information. The core platform will allow for plug-ins and extensions so that it can be customized for different locations and needs. The beta version platform is now available as an open source

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4   http://www.visionofhumanity.org/#/page/indexes/global-peace-index
5   https://peaceaccords.nd.edu/
6   http://www.du.edu/korbel/sie/research/chenow_navco_data.html
7   http://unitedforafrica.co.za/
8   http://www.humanityunited.org/
9   http://peaceheroes.ushahidi.com/
10 http://votereport.in/

application that users can download and implement and use to raise awareness of crisis situations or other events in their own locations. It is also continually being improved and tested with various partners, primarily in Kenya.[11]

The UNDP and the International Peace Institute, in the 2013 report cited above, surveyed 'horizontal' (grassroots) uses of digital collective action for violence prevention in a series of case studies of Latin America, Kenya, Kirgizstan, and Sudan. In Latin America, now one of the most digitally connected regions in the world, they reported that, across the continent, a variety of grassroots networks using digital technology and platforms have emerged that report and share information on various types of violence.

> "[…] In Brazil there are blogs that actively reflect on violence prevention measures in recently pacified slums, or *favelas*, of Rio de Janeiro. Community residents, many of whom are now purchasing tablet computers and smartphones and actively using Facebook, are tracking trends. Other ICT tools designed to prevent sexual violence and developed outside of Latin America, including Hollaback!, are establishing chapters in the region. Two other prominent examples are Say No to Violence, a social-mobilization platform established in 2009 and connected to UNiTE and Bem Querer Mulher (Cherish Women), supported by UN Women […] new ICTs are routinely emerging that explore ways of enhancing the protection of women and girls from violence in Brazil, Colombia, and Mexico, but also elsewhere." (Mancini, 2013, pp. 37-38)

CONCLUSION

It would be unwise to claim too much in terms of impact of these experiments in cyberpeacemaking, but not too big a claim to say that they are exciting in what they promise to deliver. Amongst the many challenges ahead, three stand out. First is the need to resource the continued development of these technologies. Second, there is a need for accountability, open access and ownership in the public domain, and resistance to monetising and marketising data. Perhaps the most pressing current challenge is around the control and accountability of so-called *cloud computing*, where data is held not on personal computers but in 'clouds' of data and resources, and which is driven by 'cloud capitalism'. Users often do not realise that what they take to be unimpeded global access is in fact confined within clouds controlled by providers. Examples of such clouds include Amazon, which stores and distributes books, Apple iTunes, which stores and

distributes music, and the variety of services and resources stored in the Google cloud. In response to this, Charles Leadbetter has called for an "open cloud culture" in his Open Cloud Manifesto, which intriguingly ends with a proposal for an open 'cosmopolitan cloud' to sustain a transformative emancipatory ethic of cyberspace.

> "The potential for a more cosmopolitan, open cloud, which can connect hundreds of millions of people all over the world in shared endeavours, will only be realised if we tackle these threats. We are entering a new, exciting and yet dangerous phase in the web's development. Huge untold opportunities will exist for anyone connected to the web – and by the end of this decade that will be several billion people – to draw on shared culture resources and add to them through their own creative expression." (Leadbetter, 2010)

It is only in this context and value system that cyberpeace-making can flourish. Leadbetter's reference to the power of the web to enable creative expression is another area where powerful audio-video resources are available to bring the arts (music, dance, film, theatre) and sports into the service of defining a global peace culture. The third and final challenge is to ensure the continued central role of human agency in developing human centred technology in the age of the zettabyte. Norbert Wiener warned that a technologically driven cyberspace must be focused on human needs as its core purpose. There are concerns in literature and in the popular media that even an apparently benign and humanitarian social media network might result in an Orwellian dystopia (see for example the American author Dave Eggers' novel, *The Circle*). For those who have these very real concerns, one final observation might be reassuring. Even in the age of the zettabyte, the processing power of the computer and the Internet, with all its capacity, comes nowhere near the capacity of the human body and the human mind. As Martin Hilbert has informed, 100 human brains can execute as many neural nerve impulses as all of our general purpose computers combined can execute instructions per second. Also, the 60 trillion cells in the DNA of a human body stored more information than all of our technological storage devices combined, in 2007.[12] Most reassuring and empowering of all, peacemaking and the defeat of violence requires what John Paul Lederach has called the "moral imagination", a fundamental belief in and pursuit of the creative act as a driver for peace. In so far as digital technologies can assist in this pursuit, cybernetics and cyberpeace-making provide us with an exciting new world of opportunity. ■

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11 See the USHAHIDI website at http://www.ushahidi.com/. See also iRevolution, the website of Patrick Meier, at http://irevolution.wordpress.com/.
12 For a graphic display explaining this see https://www.youtube.com/watch?v=iIKPjOuwqHo

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Recommended citation

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