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The future of warfare: Are we ready?

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Abstract

To what extent do the ways in which we anticipate threats, analyze their possible
consequences and determine ways to mitigate them explain the causes of warfare
in the future? This article – though never attempting to predict – poses plausible
causes of future wars that may stem from transformative change over the next two
decades. In asking the question "Are we ready?" to deal with such wars, the answer
is framed in terms of the interrelationship between the prospect of profound
change, emerging tensions, unprecedented violence and organizational capacities to
deal with complexity and uncertainty. To be prepared to deal with the prospect of
future wars, relevant organizations have to be more anticipatory and adaptive,
while at the same time looking for new ways to engage the wider international
community. The article concludes with a set of recommendations intended to meet
such organizational challenges – with the aspiration that the question "Are we
ready?" can be answered more affirmatively in the future.

Keywords: atomized societies, cyberspace, cyber-war, dynamic displacement continuum, outer space,
resource conflict, private sector, organizational behaviour, slumscapes, transformative change.

Introduction

Every age regards itself as unique, driven by factors deemed unprecedented and
transformative. The same is true of the first decades of the twenty-first century.
Yet despite this historical and possibly comforting perspective, the present era is

and indeed will continue to be profoundly transformative for humankind. It will mark the point at which the very nature of "humanness" will be in the hands of humans to reconstruct, and it will mark the point when human activity will become increasingly based in outer space. The former challenges the very nature of who we are; the latter moves human activity beyond the confines of the planet.

In the context of the future of warfare, the implications of such profound transformations will directly impinge upon the very concept of conflict, its instruments and its location, and in so many ways will reflect radical departures from the past. These transformations will not only determine how wars will be fought, who will be the adversaries, and where future battles will take place, but also may determine the very *raisons d'être* of warfare in the future.

One very compelling question remains: namely, are we ready?

In and of itself, the question is intriguing. Are we as human beings ready to adapt to such new forms of conflict? And, in the context of this article, will we – those who represent institutions designed in an earlier era to promote peace – be able to deal with new types, dimensions and dynamics of warfare? In a related vein, will the legal frameworks that over the course of modern history have attempted to put "civilized parameters" around the horrors of conflict be irremediably challenged by its future evolution?

This article will in various ways touch on all these issues. However, before doing so, the first section below, entitled "Transformative Agents and Global Implications", will establish the context within a 2040 timeframe in which future warfare might take place. It will, for example, consider transformative factors and how such factors might impact upon societies, their perceived interests and their vulnerabilities. It is these issues of interests and vulnerabilities that will lead into the second section, "Plausible Tensions and the Changing Nature of Warfare". This section suggests seven examples – ranging from competition over cyber control to strains between atomized societies and state structures – that link these sorts of tensions to the prospect of future wars.

States and societies having been pushed to the brink; what might the consequences be when it comes to overt violence, in this case warfare? From conflicts in outer space and virtual and robotic conflicts on the planet to nuclear capacities in the hands of non-State actors and perpetual wars arising from mass displacement, the factors that might trigger warfare in the future are terrifyingly wide, and the second section will also attempt to capture some plausible examples of the sorts of adversaries that will be involved, their locations, their weapons and their possible impacts on humankind.

What might be described as "war scenarios" are, for all their horror, relatively easy to imagine. Far more difficult is to determine the plausible criteria for assessing how ready the global community is to deal with such unprecedented forms of violence. The final section of the article, "Are We Ready?", ventures into that highly complex zone. It looks at present institutions, legal frameworks and principles as well as at the restraining factors inherent in *Realpolitik* in order to suggest our readiness. Arising out of its conclusions, the section ends with some recommendations which might enhance that state of readiness, whatever it might be.

Transformative agents and global implications

The transformations that are under way leave few unaffected around the world. While a number of analysts caution over-enthusiastic "futurists" about their single focus on technology, one might argue that in many ways, technology will in this age transform traditional as well as more innovative cultures and societies.[1] When the suggestion that the "Internet of things" will connect everything with everyone was posited, it was initially difficult to appreciate how ubiquitous the concept was. Now, in one way or another, it is generally recognized that the Internet and related technologies spill over into every dimension of human existence. *Sousveillance* and *surveillance* will by 2040 enable "all to *know* everything about everyone" globally,[2] and tactile communications, the prospect of teleportation and 4-D printing will change human interactions in ways unimaginable in the previous decade.[3] All such transformative innovations will be further developed through "big data" and artificial intelligence revolutions.[4]

Technology offers the promise of economic progress for billions in emerging economies at a speed that would have been unimaginable without the Internet. Twenty years ago, less than 3% of the global population had a mobile phone; now two thirds of the world's population has one, and one third of all humans are able to communicate on the Internet.[5] This figure could soon rise with the introduction of drone technology that will be able to link mobile

1   David Edgerton, *The Shock of the Old*, Profile Books, London, 2006. In the author's description of "use-based innovation", he cautions against assuming that innovation is consistently transformational. He suggests that "use" determines the impact of innovation, which in turn is determined by a range of factors, including levels of development, culture and society. In that context, he suggests that the horse had a greater impact on Nazi conquests than did the V2 rocket. *Ibid.*, p. xii.

2   Described by David Bolliera "as a budding counterpoint to surveillance. Surveillance, of course, is the practice of the powerful monitoring people under their dominion, especially people who are suspects or prisoners – or today, simply citizens. *Sousveillance* – 'to watch from below' – has now taken off, fueled by an explosion of miniaturized digital technologies and the far-reaching abuses of the surveillance market/state." David Bolliera, "Sousveillance as a Response to Surveillance", *News and perspectives on the commons*, 24 November 2013, available at: http://bollier.org/blog/sousveillance-response-surveillance (all internet references were accessed in October 2016).

3   Interview with Professor Murray Shanahan, Professor in Cognitive Robotics, Faculty of Engineering, Department of Computing, King's College, London, 15 April 2015. Quantum computing is yet another transformative innovation, as described in an interview with Stephen Phipson, UK Government Trade and Investment, 21 June 2016.

4   Interviews with Dr. Stuart Armstrong, James Martin Fellow, Future of Humanity Institute, University of Oxford, specializing in artificial intelligence and assessing expert predictions and systemic risk, 7 April 2015; and Professor Mischa Dohler, Chair, Wireless Communications, Centre for Telecommunications Research, King's College, London, 8 April 2015.

5   This positive statistic has to be balanced against the probability that the "penetration rates" of mobile communications need to reflect the significant differences between urban and rural areas, where the former is significantly larger: e.g., Brazil urban connectivity 83.3%, rural 53.2%; Ghana urban 63.5%, rural 29.6%; India urban 76%, rural 51.2%. Sarah Gustafson, "The Digital Revolution in Agriculture: Progress and Constraints", Food Security Portal, International Food Policy Research Institute (IFPRI), 27 January 2016, available at: www.foodsecurityportal.org/digital-revolution-agriculture-progress-and-constraints.

communication systems to a further billion people.[6] These developments will have positive impacts across an ever widening range – from farmers who can use mobile phones to negotiate crop prices with traders well outside their local communities to refugees who can compete for design contracts from their camps, the impact of technology will increasingly leave few unaffected.

At the same time, there is concern that it is not implausible that within the foreseeable future, machines will outsmart human beings. According to Cambridge University's Huw Price and Skype co-founder Jaan Tallinn, "[i]t seems a reasonable prediction that some time in this or the next century intelligence will escape from the constraints of biology".[7] Price adds that as robots and computers become smarter than humans, we could find ourselves at the mercy of "machines that are not malicious, but machines whose interests don't include us".

Hence, the seeming paradox is evident. Clearly technological advance holds out the prospect of exponential progress, while at the same time, "[s]cience and its technological application are positioned as today's greatest source of ruination".[8] Such a position is clearly *in extremis*, and the reality may be a mixture of both – as evidenced in all that is "normal life".[9]

For all its promise and potential hazards, transformative technology raises two fundamental, if not existential, issues. The first concerns who analyzes and monitors the potential implications of technological advance, who understands its consequences and cross-sectoral linkages, and ultimately who controls it. The second issue, of related concern, is the sheer dynamics and speed of technological advance and indeed the world of technology – are they even controllable?

Clearly, technology will have direct implications when it comes to how human beings will earn their living and how economies will function. While there is already emerging evidence that robotics is eating into virtually all aspects of professions, industry and agriculture in developed counties, what is increasingly evident is that employment-related prosperity forecasts for the developing world may also be negatively affected.[10] Agriculture, for example, an issue of increasing concern in a world of 7.5 billion people and counting, is forecast to be dominated by robotic technologies. One outcome of this could be an increasing amount of people seeking employment in urban areas. Alternatively, according to one source in a slightly more positive vein, "[a]pplying new technologies to farming will boost

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6   Aviva Rutkin, "First-Time Surfers", *New Scientist*, Vol. 229, No. 3059, 2016, pp. 18–19. See also: Christina Richards, "Will Internet Access Via Drones Ever Fly?", *Wired*, November 2014, available at: www.wired. com/insights/2014/11/internet-access-drones/.
7   Huw Price, Jaan Talinn and Martin Rees, "Humanity's Last Invention and Our Uncertain Future", University of Cambridge Research News, 25 November 2012, available at: http://www.cam.ac.uk/ research/news/humanitys-last-invention-and-our-uncertain-future.
8   Steve Matthewman. "Dealing with Disasters: Some Warnings from Science and Technology Studies", *Journal of Integrated Disaster Risk Management*, Vol. 4, No. 1, 2014, p. 2.
9   As with the creation of the locomotive in the nineteenth century – the positive side of this invention in terms of more effective transportation, a plethora of related innovation and new employment opportunities had to be weighed against the negative implications of coal mining for a large swathe of the poor, the expansion of slums in urban areas and deepening social divides.
10   "The Return of the Machinery Question", Special Report, *The Economist*, 25 June 2016; Sumit Paul-Choudhury, "Outsmarted?", *New Scientist*, Vol. 230, No. 3079, 2016, pp. 18 ff.

the appeal of agriculture to younger people and help increase their participation in the sector".[11]

Yet, as is also increasingly evident, the industries that have become the lure for potential city-dwellers in developing countries will also be dominated by robotics and related innovations. A case in point is "offshoring", where a combination of cheap labour and increasingly intelligent algorithms have resulted in the provision of information services in developing countries for developed countries. This had been regarded as a clear case of how new technologies will enhance employment and economic growth around the world, but the emerging reality is that technology is already tending to radically reduce human employment by replacing it with machines. And, as that occurs, analysts anticipate that offshoring will decline in favour of a return to home base – with the irony that home base will choose to use robotics, too, rather than even highly skilled workers in the developed world.

Here, again, is an emerging paradox. To what extent might those transformative factors that result in unemployment be essential for paving the way towards alternative types of employment? And, in a related vein, to what extent might the State acknowledge that it has limited control over the flows of those who create jobs, such as the private sector, and that its capacity to sustain employment and, hence, economic security is very limited? Alternatively, will the State have the resources and commitment to create new types of employment, such as active forms of social engagement,[12] and can it require, for example, even those technology-driven companies to commit themselves to include human workforces in their production schema? Or, might the alternative be that "the advantages of further conciliation pale by comparison with the threat to their already lowered standard of living"? In such a situation, "greater militancy is a normal response.... Such moments also see the intensification of less rational inter-ethnic struggle."[13] Here, the prospect of discontent and ethnic hatred could plausibly trigger conflict reminiscent of the 1940s.

While attention to this issue is considerable and growing, there is little indication that any identifiable pattern dominates the discourse. That said, should the prospect of billions out of work around the world become increasingly plausible, there appear few sustainable, recognizable solutions on the horizon. Over the next two decades, though technology will positively affect the volume and quality of resources, one of its critical effects may be that mass unemployment will in turn result in mass displacement. Analysts warn that an estimated 700 million

11 Takaki Shigemoto, Analyst at JSC Corp., quoted in Aya Takada, "Japan's Next Generation of Farmers Could Be Robots", Bloomberg, 23 April 2016, available at: www.bloomberg.com/news/articles/2016-04-23/robots-replacing-japan-s-farmers-seen-preserving-food-security.
12 An interesting example in the US context can be found in Lynn A. Karoly and Constantijn W. A. Panis, *The 21st Century at Work: Forces Shaping the Workforce in the US*, Rand Corporation, Santa Monica, 2004, p. 119: "There is also speculation that IT may be changing the nature of employer-employee relationships, with firms in the 'new economy' relying more heavily on 'alternative' or 'contingent' workers in place of traditional employees."
13 Immanuel Wallerstein, "The Global Possibilities 1990–2025", in *The Age of Transition: Trajectory of the World System, 1945–2025*, Pluto Press, Leichhardt, 1996, p. 227.

people will become refugees, economic migrants or internally displaced.[14] Many of these will be in or will move to urban areas, where unemployment in what the second section of the article, below, defines as "slumscapes" will result in an explosive mix of poverty and isolation, creating triggers for further displacement.[15]

In that context, one analyst has suggested that "the greatest risk is that we could face a 'perfect storm' – a situation where technological unemployment and environmental impact unfold roughly in parallel, reinforcing and perhaps even amplifying each other".[16]

The prospect of mass unemployment and displacement at a time when one can foresee exponentially increasing advances in life-prolonging and life-enhancing health care suggests another irony. A growing number of innovations, such as telemedicine and tactile communications as well as nano-implants, will enable both specialists and "non-specialists" to monitor well-being and determine measures to deal with illness. DNA creation and modification, along with biotechnology and nanotechnology, will result in a radical reduction of illness, both physical and mental. And, over the course of two decades, it will be interesting to see the extent to which manufactured body parts will be able to replace more and more components of the human body.

All these advances – due in part to their "non-specialist" accessibility – should be available to a wide spectrum of people, and while the benefits will most likely not consistently benefit the very poor, even they will be sporadic beneficiaries. Furthermore, while medical advances will result in unquestionable benefits for a large swathe of human beings around the planet, the negative effects of climate change on health may well become "the biggest global health threat of the 21st century", and will be multifaceted.[17] Climate change will indeed be a major health issue; its consequences will inevitably touch upon all aspects of human existence. In that regard, the United Nations (UN) anticipates that climate change will be "the defining issue of our age".[18]

Water and agricultural production will be severely affected, positively and negatively, both by climate change and related aspects of transformative innovation. Here, once again, is a tension between the positive and the negative. When it comes to water, there is a well-established belief that increased water supplies due to industrial desalination would effectively free the world from the constraints of

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14 United Nations Convention to Combat Desertification, *Desertification: The Invisible Frontline*, Bonn, 2014, p. 5.
15 The World Economic Forum (WEF) has noted that in "many developing countries, migration from rural areas to cities is at least partially driven by the increasing prevalence of extreme weather, such as land degradation and desertification, making agriculture more difficult". Subsistence farmers and those whose livelihoods depend upon the land will naturally be amongst the worst affected. WEF, *Insight Report: Global Risks 2015*, 10th ed., report, Geneva, 2015, p. 34.
16 Martin Ford, *The Rise of the Robots: Technology and the Threat of Mass Unemployment*, Basic Books, New York, 2015, pp. 283–284.
17 Anthony Castello *et al.*, "Managing the Health Effects of Climate Change", *The Lancet*, Vol. 373, No. 9676, 2009.
18 Ban Ki-Moon. "Opening Remarks at 2014 Climate Summit", *UN News Center*, 23 September 2014.

drought and water scarcity.[19] However, a significantly less optimistic picture of water availability is drawn by a number of authors, one of which foresees countless disputes, from Slovakia and Hungary to Namibia and Botswana to the American state of Georgia, which "has threatened to call out the National Guard during a feud with Florida and Alabama over the Chattahooche [river]".[20] Similarly, there are those experts who foresee a viable though uneven picture of agricultural production around the world.[21] This prospect in the foreseeable future will be due not only to more integrated planning, but also to the extensive use of technology-based innovations such as genetically engineered crops and global positioning systems that enable precise yield and location data to be correlated with soil samples and sensors to adjust fertilizer application.[22]

The much-discussed energy-water nexus is fast becoming the energy-water-food-land-metal nexus, as resources become ever more interdependent. Water is perhaps the most striking example, because with the prospect for limited access in the future, decisions will need to be made about where and how it will be best used. Does one prioritize the use of water for the creation of energy, for the mining of resources, for the production of food, for industry, sanitation or consumption?

Furthermore, in considering the reliance of these activities upon each other (energy, for example, is essential for all of these activities), the challenge becomes graver. With the use of biofuels set to triple by 2040,[23] an interesting battlefield is being staged as the debate rages over the wide-scale use of water and land in the production of this alternative, "renewable" energy source.

It is more than likely that resource efficiency and recycling will increase over the next few decades,[24] facilitating a reduction in the demand on some resources. Additionally, several new technologies will likely be viable by 2030, including fuel cells, solar cells and, as noted earlier, advanced desalination techniques.[25] It is also possible that resources may begin to be retrieved further

19 UK Ministry of Defence, Strategic Trends Programme, *Global Strategic Trends – Out to 2045*, London, 2015, p. 24. Amongst a growing number of innovative approaches to desalinization and water availability is an initiative undertaken by Jordan and Israel, where the former, through captured solar energy, would provide electricity to drive Israel's desalinization plants on its Mediterranean coastline. "Utilities in the Middle East", *The Economist*, 16 January 2016, p. 53.

20 Diana Raines Ward, *Water Wars: Drought, Flood, Folly and the Politics of Thirst*, Riverhead Books, New York, 2002, pp. 9 ff.

21 F. W. T. Penning De Vries, H. Van Keulen and R. Rabbinge, "Natural Resources and Limits of Food Production in 2040", *Systems Approaches for Sustainable Agricultural Development*, Vol. 4, 1995.

22 IFPRI, in its Food Security Portal, states that information and communications technologies can increase access to weather and market information, and help farmers make better informed decisions about when and where to sell crops. Examples include the Tigo Kilimo mobile app in Tanzania and the Connected Farmer mobile programme in East Africa. IFPRI warns, however, that voice messages need to be properly targeted between the farmer and the information source, and too often are not. See S. Gustafson, above note 22.

23 International Energy Agency, *World Energy Outlook 2014*, Paris, 12 November 2014, p. 4.

24 *Ibid.*, p. 43.

25 Richard Dobbs, Jeremy Oppenheim, Fraser Thompson, Marcel Brinkman and Marc Zornes, *Resource Revolution: Meeting the World's Energy, Materials, Food, and Water Needs*, report, McKinsey Global Institute, New York, 2011, pp. 134–135.

away from home, with investment already being ploughed into the space mining industry.[26] The rewards stand to be enormous, with one asteroid that recently passed Earth offering a $5 trillion platinum core, worth more than Japan's entire economy.[27]

It is with the spectre of resources beyond the Earth's atmosphere that the transformative consequences of human involvement in outer space becomes an ever more important consideration. There are few aspects of life on Earth that will not be directly affected over the next two decades by human activity in outer space, even including the way that gross domestic product is assessed.[28] The proliferation of satellite communications beyond the Earth's ionosphere means, for example, that agricultural conditions will be monitored to assess ways to maximize agricultural opportunities, which analysts anticipate will significantly increase production levels.[29] Similarly, it is assumed that energy resources taken directly from the sun have the potential to eliminate the need to search for alternative energy sources on the planet.[30]

By the late 2030s, NASA and the European Space Agency forecast that capacities will exist which can anticipate as well as respond to a wide range of possible disaster drivers, including earthquakes, floods and droughts.[31] Similar aspirations also drive the UN's SPIDER project, which already provides satellite-based services for supporting efforts to deal with global challenges such as climate change, global health and human security.[32] And, it is increasingly evident that outer space technologies will in the foreseeable future be able to monitor patterns of conflict in war zones as well as to *anticipate* flows of displaced people around the world.[33]

There is, at the same time, a considerable downside. The UN's Fourth Committee (Special Political and Decolonisation) expressed concern in October

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26 According to the *New Scientist*, an asteroid mining firm, Planetary Resources, "has revealed the first object 3-D printed from meteorite ore, a scale model of one of its spacecraft parts. The rock was found on Earth, but in future the company plans to mine and manufacture in space." "60 Seconds", *New Scientist*, Vol. 229, No. 3056, 2016, p. 8.

27 Eric Mack, "'Trillion Dollar Baby' Asteroid Has Wannabe Space Miners Salivating", *Forbes*, 19 July 2015.

28 Vernon Henderson *et al.*, "Measuring Economic Growth from Outer Space", *American Economic Review*, Vol. 102, No. 2, 2012.

29 It is interesting to note in this context that, according to the *New Scientist*, the Ethiopian director of Ethiopia's Entoto Observatory and Research Center, Solomon Belay Tessema, has stated: "A space programme is not a luxury, but a key to securing food, increasing the productivity of agriculture and developing scientific thinking. Space technology is important for many things: satellites, for instance, are used for environmental and water management, and soil assessment. We use them for disaster planning to gather meteorological data and to improve communications." Linda Geddes, "From Ethiopia to the Stars", *New Scientist*, Vol. 229, No. 3057, 2016, p. 27.

30 See, for example, Paul Marks, "Star Power: A Global Contest Is Under Way to Tap the Sun's Energy from Orbit. Is this the Start of a Second Space Race?", *New Scientist*, Vol. 229, No. 3060, 2016, pp. 38 ff.

31 See, for example, Catherine Cheney, "NASA and USAID pioneer the use of space technology for development efforts", Devex, 1 July 2016, available at: www.devex.com/news/nasa-and-usaid-pioneer-the-use-of-space-technologies-for-development-efforts-88365.

32 UN Office for Outer Space Affairs, *Space Matters*, August 2011.

33 See, for example, Anja Shortland, "Studying Somalia's War Economy from Outer Space", Stockholm International Peace Research Institute (SIPRI), 11 September 2013, available at: www.sipri.org/commentary/blog/2013/studying-somalias-war-economy-outer-space.

2014 that a new global hegemony may emerge in the foreseeable future, based upon scientific and technological capacities in outer space. The ability of a relatively few governments and private-sector bodies to dominate essential resources globally may for many result in deep poverty and vulnerability, as has been the case in the past. All too frequently have technological and economic advances in turn resulted in socioeconomic disparities – a fact well known to many analysts, including economic historians and sociologists.[34]

In this context, the interrelationship between outer space and cyberspace may well be in the hands of a relative few,[35] and its consequences clearly global in impact. The more intensely that interrelationship grows, the more likely it is that the disruption of one system, such as a satellite system, will seriously affect an important cyber-system. Debris, for example, from an asteroid or meteorite might collide with a satellite, which could profoundly disrupt a plethora of Earth-based services, including those designed for security purposes. Large swathes of human beings would ultimately find themselves without the most basic resources and means of survival – whatever their socioeconomic status – and, in many ways, without protection.[36]

Implications for global governance: Challenges to the "State"

With all the negative as well as positive effects of technology and its relationship to human agency, employment and displacement, resources and basic means of survival, the issue of governance becomes a critical – indeed, potentially transformative – factor in the ways in which societies will structure themselves and allocate their resources.

State authority from this perspective will clearly be a key consideration when it comes to addressing the conundrums that may result from transformative factors. In this regard, the State's ability to keep pace with such factors is clearly an issue of fundamental importance. Some have argued that the sheer speed and flexibility of the private sector and other atomized networks will enable them to outpace and outmanoeuvre governments, except when the former deem the latter to be useful.

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34 See, for example, Joseph Stiglitz, *Globalisation and its Discontents*, Allen Lane, London, 2002, pp. 153 ff.
35 As stressed in a 24 January 2013 conference on "Making the Connection: The Future of Cyber and Space": "the increasing interdependence and interconnectedness between space and cyberspace comprises an important development affecting both fields. On the one hand, space components (including satellites and base stations) have become an integral part of cyberspace. An unprecedented quantity of data is being generated and transmitted by satellites on a daily basis with an accompanying rise in space-enabled services." Royal Institute of International Affairs, London.
36 The UK government's National Space Policy notes that "space has become increasingly important to modern Britain. This trend is set to continue as societies in the developed and developing worlds rely increasingly on space based assets as one of the critical infrastructures to meet the needs of an estimated population of 9 billion in 2050. Satellites will assist with better management of scarce resources, offer improved communications and support more efficient use of energy. Our global space assets are rightly recognized as part of our critical national infrastructure, and space weather is included in our national risk assessment, acknowledging the risk it represents to both space and ground-based facilities. Once the domain of only those who understood rocket science, space is now a leveller of society in developed and developing countries." Government of the United Kingdom, National Space Policy, available at: https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/484865/NSP_-_Final.pdf.

A related concern is that States, in their determination to grapple with the consequences of mass unemployment, unparalleled urbanization and an undisciplined private sector, may use their authority to introduce "solutions" that are gross abuses of civil rights. They may well attempt to cut off or at least limit the myriad strands that comprise atomized networks.

With that in mind, the prospects for State-based governance systems and structures to deal effectively with societal transformations remain uncertain. Those who try to grasp the relationship between the possible future of governments and the basis of their authority, accountability and allocative processes will inevitably have to contend with an increasing array of uncertainties. Amongst these, there are a range of issues that need to be addressed when it comes to governance and complex systems.

The definition of "State" is one such issue, and in a 2040 context may require further reconsideration, if not redefinition. While it is generally assumed that the role of the State as the basis of governance will remain central in the global system over the next two decades, the very nature of the State may change. The assumption that fixed boundaries, defined populations and ultimate control over assets and currencies are all fundamental aspects of the State may well be challenged in various ways. The growth of city-to-city collaboration, the mass movements of displaced peoples flowing across borders and the very dynamics of atomization would seem to suggest that State boundaries may be increasingly fluid, if not uncontrollable. The effects of innovations that could include teleportation, tactile communications and 3-D and 4-D printing may further intensify such fluidity.

Increasingly, too, there is a view that transformative factors such as cyber-cash will represent a further challenge to State authority. Cyber-cash, as one example, may well leave the State's authorities with little control over one of its main instruments of economic management, namely its currency.[37] In a similar vein, the likelihood that outer space exploration and interests might be promoted by the private sector could also find private-sector interests determining those of States. While the "military-industrial complex" is by no means a new phenomenon, the possible dependence of the State upon the self-funded innovations, exploration and resource "mining" of the private sector might significantly reduce the influence that the State has over the private sector, diminishing States' traditionally perceived "monopoly of power".

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37 Cyber-cash – an expansion of the "bitcoin" concept – reflects an interesting example of the tension between State authority, States' institutional adaptiveness and the unconstrained independence of alternative networks. A bitcoin, the most basic component of one form of cyber-cash, has been described as nothing more than a unique string of numbers, not tied to any real-world currency. Its strength and value come from the fact that people believe in it and use it. "Anyone can download a bitcoin wallet on to their computer, buy bitcoins with traditional currency from a currency exchange, and use them to buy or sell a growing number of products or services as easily as sending an e-mail. Transactions are secure, fast and free, with no central authority controlling value or supply, and no middleman taking a slice." Jamie Bartlett, *The Dark Net: Inside the Digital Underworld*, Melville House, Brooklyn, 2015, p. 74.

Faced with these sorts of contending and draining pressures, the State may have to accept that private-sector institutions and social networks – intentionally or inadvertently – will assume many services, such as security and welfare, that are normally deemed to be within the purview of the State. The consequence could well be that those with the means will be prone to opting out of engagement with State structures, be they authoritarian or democratic, leaving those who cannot afford to do so trapped in an ever more financially insecure space. And with such a prospect, many argue that State structures and activities like taxation will be negatively affected, as will the State's monopoly over the legitimate means of violence.[38] This in turn may result in a deepening divide across societies – and with that divide, new sources of insecurity.[39]

On the other hand, so-called "sovereign States" might embark on collective ways to deal with such complexities and insecurities. With or without inter-governmental organizations, they may attempt to find ways to gain agreement on what might be seen as common issues of survival. "Minilateralism" and the prospect of growing multipolarity are potential alternatives to some.[40] Common interests and common insecurities may at least be responsible for arrangements on functional issues such as "runaway climate change" and pandemics; international crime and seemingly uncontrollable capitalism may prove to be other issues that could stimulate some form of cohesiveness. The requisite State authority for achieving such aims is, however, not regarded as a given.

One possible challenge to the conventional State structure is what has been called "the atomized society". The atomization process combines "the Internet of things" with universal digital access – the transformative consequences of which may well be far more fluid approaches to authority and governance, based upon networks that are far more creative and responsive than contemporary organizational systems. Atomization, in other words, is a process by which social, political and economic dynamics are determined principally by fluid, self-organizing entities that exist in parallel and normally independently of conventional structures.

Atomization may well, in various ways, challenge States' assumptions about their capacities to control and regulate economic, social and resource-related activities. In that context, it could also put into question States' supposed "monopoly of power". To what extent might the consequences of cyber-cash, private interests in outer space, social networks' influence over cyberspace and myriad other reflections of power remain within the purview of the State?

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38 United States Institute of Peace, "Legitimate State Monopoly Over the Means of Violence", available at: www.usip.org/guiding-principles-stabilization-and-reconstruction-the-web-version/6-safe-and-secure-environment/le.
39 National Intelligence Council (NIC), *Global Strategic Trends*, draft, March 2015.
40 "[L]et's forget about trying to get the planet's nearly 200 countries to agree. We need to abandon that fool's errand in favor of a new idea: minilateralism. By minilateralism, I mean a smarter, more targeted approach: We should bring to the table the smallest possible number of countries needed to have the largest possible impact on solving a particular problem. Think of this as minilateralism's magic number." Moises Naim, "Minilateralism: The Magic Number to Get Real International Action", *Foreign Policy*, 21 June 2009.

A related uncertainty has to do with the extent to which such social divides are controllable, and what measures States might require to deal with these divisions. From the perspective of the World Economic Forum, the options for States as well as for governments and civil society will depend upon new forms of leadership and more collective and holistic solutions to ever mounting problems. If such solutions are not found, the question seems to be answered in terms of what might be regarded as

> the "new normal" … a combination of volatile markets, a lack of political will to deal conclusively with long-term issues, the recurrent mobilization of the general public in social protest and a remarkable ability by leaders to nevertheless continue to push "the next big crisis" to future generations.[41]

This is a prospect that some in the United States – still the wealthiest nation in the world – regard as all too possible.[42]

Such considerations flow naturally into concerns about the very nature of "the organization" in such rapidly transformative times. The majority of organizations, and certainly those found in most governmental bodies, are relatively insensitive to substantive change. As organizations, they are inherently linear, siloed and reductionist in approach when it comes to defining problems and solutions. Many distinguished analysts have sought to reform organizational processes, but it would appear that despite myriad evaluations and subsequent recommendations proffered over the years, "structuralism" remains very much in place. It is reflected in such terms as "top-down" and "best practice", and in assumptions that "leadership" is vested in decision-makers at the top of hierarchies and that "efficiency" – rather than effectiveness – is an essential element for achieving success. Yet those who look at organizations through the lens of profound changes in technology, societal structures and globalization are increasingly doubtful about the effectiveness and in various ways the utility of the conventional organizational construct.

Reflecting upon the types of transformative factors, their plausible dimensions and consequences, each – individually and collectively – will reflect compatibilities and incompatibilities that will in turn determine and be determined by social constructs, political and economic systems, perceptions of security and organizational dynamics. They will reflect and be reflections of emerging tensions between atomized societies and State structures and between emerging socioeconomic equality or disparities. It is these sorts of tensions that for the purposes of this article may lead one down the path of war in the future.

Plausible tensions and the changing nature of warfare

There are innumerable causes of tension that could result from such transformative factors, and these causes in turn provide insights into the triggers that suggest

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41   WEF, *The Future Role of Civil Society*, World Scenario Series No. 28, 2013.
42   In this context, the president of the United States, Barack Obama, referred to the growing gap between rich and poor in the United Sates in his January 2016 State of the Union address.

plausible types of warfare in the future. Each of the examples noted below can be seen as a standalone, but each in various ways could inevitably relate to the others. Examples of possible sources of tensions and resulting types of future warfare would include:

- atomized societies, State structures and the dynamics of attrition;
- displacement as a violent continuum;
- cyberspace and outer space;
- uncertain asymmetries;
- resource competition and resource conflict;
- transcendent health threats and conflict triggers;
- organizational paralysis and future sleepwalkers.

It should be noted that the tensions which may emerge need not necessarily lead to conflict. Their possible consequences might result in negotiations and ultimately mutually acceptable arrangements. They, too, might just be tolerated, and an uneasy but not overtly conflictual situation might continue over time. However, this discussion will assume that the tensions in the seven categories listed above will lead to conflict, and each will provide insights into the future of warfare.

In looking at the future of warfare, it would be difficult to ignore conventional state conflicts that have marked so much of history, certainly since the Peace of Westphalia in 1648. One writer with considerable experience in the subject has warned of an emerging "new cold war", with all the portents that that could mean in terms of State-to-State conflict.[43] Yet, while this dimension may continue to be a reflection of warfare in the foreseeable future as well as the past, this article will generally focus on forms of warfare that will result from what we have called "emerging tensions".

As these emerging tensions begin to lay the groundwork for future war scenarios, it is important in the first instance to recognize certain crosscutting themes that will most likely be at play in all future conflicts. These would include the use of big data and artificial intelligence for purposes such as surveillance and planning, robotics, drone-related technologies, use of outer space and nano-technological mechanisms and cyber-war. In other words, it is more than likely that warfare in general will witness the application of these features, whatever the types, dimensions and dynamics of forthcoming wars.

An issue that is already rising on the international agenda is the artificial intelligence-related technology that can select its own targets and autonomously decide whether to destroy them. In April 2015, the UN spent five days debating "lethal autonomous weapons systems" – the second such meeting in as many years. While it is assumed that this discussion will continue in 2016, there are few who see measures to control such technologies emerging from these talks. Yet, the fact that they are occurring at all demonstrates the existence of an emerging

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43 Edward Lucas, *The New Cold War: How the Kremlin Menaces both Russia and the West*, Bloomsbury, London, 2008.

anxiety and creates an international platform for exploring the autonomy, hackability, accuracy and safety mechanisms of such weapons.[44]

Clearly, robotics is recognized as a significant logistical aid in times of conflict. The potential use of robots for transporting a wide range of material over difficult terrain is already in evidence, but it goes well beyond that. "Something big is going on in war today, and maybe even the history of humanity itself." According to a US Air Force three-star general:

> Where we're headed very soon is tens of thousands of robots operating in our conflicts, and these numbers matter, because we're not just talking about tens of thousands of today's robots, but tens of thousands of these prototypes and tomorrow's robots, because of course, one of the things that's operating in technology is Moore's Law, that you can pack in more and more computing power into those robots, and so flash forward around 25 years, if Moore's Law holds true, those robots will be close to a billion times more powerful in their computing than today.[45]

Similar to the rapid emergence of robotics is the related development of drone technology. Both at this stage remain imperfect weapons of war, and the latter's algorithmic capacities have been held responsible for the reported deaths of untold numbers of non-combatants,[46] though they are increasingly part of the arsenals of States such as China, Russia, Iran, Pakistan, the United States and thirty-nine others. Both robotic and drone technologies are relatively inexpensive to develop, and both are readily accessible to non-State as well as State actors. In 2009 it was reported that

> during the war between Israel, a state, and Hezbollah, a non-state actor, the non-state actor flew four different drones against Israel. There's already a jihadi website that you can go on and remotely detonate an IED in Iraq while sitting at your home computer.[47]

Outer space applications, too, reflect ubiquitous, crosscutting themes. There are probably very few wars in which outer space technologies will not play a prominent role. In recent discussions on disarmament, the UN's First Committee noted that the outer space environment was becoming increasingly "congested, contested and competitive".[48] And, in a related vein, a senior European intelligence official was quoted as saying: "I don't think that there is a single G7 nation that isn't now looking at space security as one of its highest military priorities and areas of strategic concern."[49]

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44 "Who Pulls the Trigger?", *New Scientist*, Vol. 229, No. 3056, 2016, p. 5.
45 This quote is taken from a TED Talk given by P. W. Singer, "Military Robots and the Future of Warfare", February 2009. At the time, Singer was director of the 21st Century Defense Initiative at the Brookings Institution, Washington, DC.
46 Martin Robbins, "Has a Rampaging AI Algorithm Really Killed Thousands in Pakistan?", *The Guardian*, 18 February 2016.
47 P. W. Singer, above note 45.
48 68th General Assembly, First Committee, 17th Meeting, 5 October 2013.
49 A European intelligence official as quoted in Sam Jones, "Satellite Wars: A New Arms Race Threatens Security in Space", *Financial Times*, 21/22 November 2015.

Such security concerns involve weapons in outer space, for example, that can destroy satellites upon which vast numbers of Earth-based cyber-networks depend, or so-called "rods from God", spaced-based tungsten weapons that could be deployed within minutes, with "almost guaranteed first-strike capability; effectively placing every nation on earth within the targeting scope".[50]

Outer space, artificial intelligence and big data, related cyber-systems and drone technology all link into another factor that will characterize virtually all warfare in the future: namely, "all-knowing surveillance" capacities. Even in present times, traditional intelligence capacities – the spy networks, the surveillance services, the intelligence headquarters – are all deeply dependent upon cyber-capacities. So, too, in warfare, the ubiquitous, all-seeing ability to monitor enemy movements, types of weapons and the impacts of conflict on civilians as well as the military, and even to predict an enemy's next moves, are all facets of surveillance in times of future wars.

As one looks to the future of warfare, in various ways it is not merely the means of conflict that will change, but also the *nature* of combatants, and in many ways, the motives that determine and drive conflict. Throughout modern history, it has been the State that has had a "monopoly of power" and generally, whatever the motives, has been the principal source of international conflict. Increasingly, there have been exceptions. However, as one looks to the future, actors who do not necessarily reflect the "State", *per se*, are combatants in their own right, with motives that do not necessarily reflect State-based interests.

There is a further dimension that must be considered. The costs of war in terms of blood, overt battlefield confrontations and leaders' "call to arms" may well not be the spectre of future wars, certainly not in their initial stages. Paradoxically, the catastrophes that could ensue from the widening range of future weapons may initially take place in an environment of remoteness, in a distance that separates the reality of cataclysm from the psychological space of "the virtual". In no sense is this to suggest that the consequences of future warfare could be any less cataclysmic than those of the past; to the contrary, their impact could in so many ways be existential. The horror, however, may be that an understanding and appreciation of conflicts' consequences could be hidden too long in the minds of decision-makers as well as those of the public. The robotic, drone and AI dimensions of conflict, combined with ubiquitous computer-based war games, may well change the way wars are seen – may make the horrors of weapons of unprecedented impact and their potential consequences all seem less threatening to the body politic until the conflagration begins.

While the causes, instruments and battlefields of wars of the future will change in so many ways, so too will the consequent victims of violence. The exponential increase in the global population, the vast numbers who will occupy urban areas and the potentially global impact of cyber-weapons will inevitably mean that the difference between combatants and those deemed to be killed or

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50 Matthew Beard, "Militarising Space: Weapons in Orbit", in Jai Galliott (ed.), *Commercial Space Exploration: Ethics, Policy and Governance*, Routledge, London, 2015, p. 117.

wounded due to "collateral damage" will be a distinction that is less and less relevant. The future of warfare may well mean that all could be vulnerable. The affected – be they military or civilian – will be the victims of the same sorts of weaponry, and battlefields will know no bounds. Death in one sense might mean the end of any differentiation between the military soldier and the civilian.

Of course, such grim speculation may be offset by the use of robots that may reduce "the kill chain", for example through pre-emptive technological strikes. Yet, while all such more positive possibilities may be in the offing, the plausible may be significantly less optimistic.

These sorts of broad themes will most likely be reflected in all wars in the future, influencing the ways in which they are fought and the nature of battlefields, combatants and their arsenals. Yet, while such themes may pervade conflicts in the future, there will at the same time be different types of tensions that will result in different types of wars. Below are seven cases in point.

Atomized societies, State structures and the dynamics of attrition

Tensions between what earlier had been called "atomized" societies and State structures would seem very plausible. One example of such tensions might arise from the inability of either to dominate the other, and efforts to do so may bring, for example, cultural, religious and functional networks into contention with increasingly assertive State systems.

Another example may result from tensions arising from individual States' differing perceptions and approaches about ways to control the consequences of atomization. As mentioned in the previous section, a case in point could be "cyber-cash", which might become a driving force in parallel economies throughout the world.[51] Some States may accept such developments because cyber-cash users such as the private sector may well – perhaps paradoxically – be regarded as allies in sustaining government authority. However, since currency control may be perceived by other States as a principal reflection of a State's *raison d'être*, they may well see the expansion of cyber-currency as a distinct threat to their authority.[52] Atomized societies entail a plethora of actors, including the free-flowing private sector, city-to-city alliances, social networks and non-State actors such as "terrorists". All in one way or another will be able to confront the authority of the State, and this challenge could well translate into conflict on several levels. In one of its most violent forms, non-State actors will be able to access and operate devastating weapons such as nano-technological and nuclear threats, over which the State has traditionally had control. These sorts of arsenals will result in the prospect of large swathes of citizens being held

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51　See above note 37.
52　Humanitarian Futures Programme, *Is Cash Transfer Programming "Fit for the Future"? – Final Report*, January 2014, available at: www.humanitarianfutures.org/publications/is-cash-transfer-programming-fit-for-the-future-final-report/.

hostage to the whims and dictates of a few, unconstrained by even the slimmest form of recognized international principle or obligation.

War of a different order may well also arise, involving the manipulation of products and resources by non-State actors such as the increasingly freewheeling private sector. As one leading analyst has suggested, "[i]n a world where geo-economics are as important as geopolitics and strategy, we need to worry about the spectrum of vulnerability. It is not just military assets that [are] a problem ... but our entire societies."[53]

In one sense, this prospect shares many characteristics of Ludendorff's concept of "total war" in which the complete mobilization of all resources, including policy and social systems, is focused on winning the war.[54] However, there are substantial differences, and they begin with the actors involved in conflict and the means at hand to bring States and societies to their knees. For example, the hold that many companies might have over State authorities could well lead to resource depletions, which *in extremis* could substantially reduce citizens' access to basic needs and the revenues required by the State to maintain the very functions of State. The State, on the other hand, might try to use whatever remaining hold it may have over the Internet and related technologies to combat the manipulations of the atomized actors.

This sort of warfare might be described as "the violence of strangulation", where each side tries to choke off the capacities of the other. This theme is closely related to that of "urbicide" and infrastructural warfare, in which both widen "the traditional field of reflection on political violence towards a 'non anthropocentric humanism' that includes the material surroundings of community life and heterogeneity as part of targets of violence".[55]

In a lesser form, the shutdown of Ukraine's electricity network by still "unidentified" terrorists is an event that could happen on a significantly larger scale. Warfare in this instance is not about flows of blood, but rather about the impoverishing of non-combatants and the erosion of infrastructures. A mix of alliances in which other networks, including non-State actors, could be persuaded of the rightness of each protagonist's cause, and States seeking similar arrangements or alliances with other States, could further exacerbate extreme violence.

Displacement as a violent continuum

The world is already becoming used to large flows of people seeking improved and more secure lives. The present, however, cannot be compared to the volume of

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53 S. Jones, above note 49.
54 Jan Willem Honig, "The Idea of Total War from Clausewitz to Ludendorff", in *The Pacific War as Total War: Proceedings of the 2011 International Forum on War History*, National Institute for Defence Studies, Tokyo, 2012.
55 Sara Fregonese, review of Martin Coward's *Urbicide: The Politics of Urban Destruction*, in *Global Discourse: An Interdisciplinary Journal of Current Affairs and Applied Contemporary Thought*, Vol. 1, No. 2, 2010, p. 196.

migrating peoples that may well be on the move over the next two decades. A possible though not inevitable combination of resource depletion (e.g., water scarcity) and an exponential increase in population may result in mass flows of people, which may in turn severely add to survival stresses. These may result in economic threats and conflict.

While an estimated 66% of the world's population are predicted to be "urban dwellers" by 2050, the reality might be that a significant proportion will reside only sporadically in urban areas. "Urban", for many, will be just part of a displacement continuum. Rather than a fixed entity, the notion of "urban environment" might better be seen as part of a dynamic continuum that makes little distinction between human settlements as exclusively rural or urban. From this spectrum-based approach, the urban environment is but one component of human flows and processes that will see hundreds of millions regularly on the move in search of basic subsistence. From this perspective, the urban space will become a site of constant change and uncertainty, its fluidity made ever more complex by layers of economic, political and social change occurring within and outside of a given urban settlement. Such unsettling dynamics may lead even more governments to continue to do what they have already begun to do – namely, to attempt to keep the displaced out of urban areas,[56] or alternatively, isolate the displaced in slumscapes.[57]

This dynamic displacement continuum will see the development of both "slumscapes" and "no man's lands", and both will foretell of intractable poverty and vulnerability. The former will reflect around 35% of most urban areas, clustered in isolated communities, where little investment will be made in basic services – e.g., limited access to water and electricity, and lack of attention to infrastructure affecting, amongst other things, access to the Internet[58] – and deep surveillance will limit the movements of those in slumscapes to more developed urban areas.

The "no man's land" will reflect large masses of peoples that will settle in areas which States have no will or capacity to control. By definition, these areas will lack water, employment and significant agricultural potential. In all likelihood, those that represent the dynamic continuum of displacement will look, for example, to the water and agricultural resources of others. This search will in turn intensify displacement, as those in slumscapes and no man's lands may be forced to move

56 "Among 185 countries with available data in 2013, 80 percent of Governments had policies to lower rural to urban migration, an increase from 38 per cent in 1966 …. In 2013, the proportion of Governments that had policies to lower rural to urban migration was higher in less developed regions (84 per cent) than in more developed regions (67 per cent). Between 1996 and 2013, the proportion of Governments with such policies had increased in both more and less developed regions, as well as across major regions." United Nations Department of Economic and Social Affairs, Population Division, *World Population Policies 2013*.
57 Humanitarian Futures Programme, *Mapping the Way Forward: Urban Futures Project Report*, King's College, London, October 2013, p. 21, available at: www.humanitarianfutures.org/publications/mapping-the-way-forward/.
58 In the Pew report *Digital Life in 2025*, a director of operations for social network MetaFilter is quoted as saying that "the internet will help the rich get richer and become a tool to further marginalise people who are already living with poverty, mental illness, and other serious challenges". Pew Research Center, *Digital Life in 2025*, 11 March 2014, available at: www.pewinternet.org/2014/03/11/digital-life-in-2025/.

into increasingly hostile environments, or the slumscapes may indeed become hotbeds of conflict themselves. Not only will this cascade into deepening vulnerability, but the likelihood is that the tensions between efforts to control and efforts to survive will create considerable stress. This pattern in turn will most likely escalate as greater disparities, poverty gaps and States' concerns over uncontrollable boundaries create a potential cauldron of violence.

Not dissimilarly to the dynamics of atomized societies, the displaced will resort to a wide range of networks and aggressive tools and measures to gain the resources they need, and will in turn be confronted by States determined to ensure their authority. Many of these displaced will be trapped in no man's lands, where States may resort to heavy military responses to prevent any substantive migration across contested boundaries. Perhaps a remote but possibly suggestive example of this sort of momentum has been reflected in the increasing number of conflicts between asylum seekers and government authorities in Europe in 2015 and 2016.

The difference, however, between the asylum seekers during this period and those that will appear in two decades' time is that the latter flows of migration will be dramatically larger, possibly analogous to the flows of tribes in north-east Asia in the twelfth century. Similarly to nomadic peoples, displacement will reflect substantial floating populations, moving across continents, testing the boundaries of established States and being resisted with increasing violence. And, unlike the 14 million refugees that moved between Pakistan and India in 1947, the vast numbers that one can foresee in the future will also have access to sophisticated weapons. These could include updated versions of nuclear apparatus such as special atomic demolition weapons, which enable an individual to transport and detonate a nuclear device anywhere. Migrating populations of the future will reflect a complex admix of society in general, including criminal elements and radical opposition groups, and will have access to the sorts of light, portable weaponry that one can well foresee in the future.[59] They too will have the capacities to monitor opposition movements, and may well have links to disaffected, sympathetic individuals within those States resisting the perceived threat of mass displacement.

In some instances, States may form alliances to ensure that such mass displacement does not violate shared boundaries. More realistically, however, States threatened by these sorts of movements will find themselves in contention, seeking to turn neighbouring states into no man's lands. War in this sense may

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59 The complex admix of refugee populations in the future has already been suggested by US NATO Commander General Phillip Breedlove, when he noted that "ISIS is spreading like cancer among refugees". Alan Yuhus, "NATO Commander: ISIS 'Spreading like Cancer' Among Refugees", *The Guardian*, 1 March 2016. Certainly, since Rwandan refugees were encamped in Zaire, criminals in refugee camps had become a recognized phenomenon, and criminals as well as radical opposition groups had a wide range of conventional weapons. Ever easier access to more sophisticated and lethal weapons may well mean that radical opposition groups and criminal elements in the refugee camps of the future will also have access to more sophisticated weaponry. See, for example, British Broadcasting Corporation (BBC), "The Terror Trader", documentary, Episode 5 in the series *Nuclear Secrets*, 2007.

involve resistance not only to mass displacement, but also against other States that try to resist it.

Cyberspace and outer space

"[S]pace systems are now part of cyberspace, and thus ... space doctrine in the future will be heavily dependent upon cyber doctrine. The argument can also be made, however, that cyberspace, in part, exists and rests upon space-based systems."[60] The interrelationship between outer space and cyberspace is increasingly evident in many operational areas. From a terrestrial point of view, space-based systems may appear to operate in a distant realm, but from a cyber point of view, space systems are no different to terrestrial ones. Certainly this is the case in the area of defence, where cyber-attacks may become critical operations of adversaries. More and more, space power may well determine global power.[61]

As this prospect becomes increasingly plausible, it has to be noted that already an abundance of satellites are demonstrating how outer space will become the operating determinant of Earth-based systems. And with that in mind, the disruption that would result from space debris or particles of a meteorite affecting satellites could be a major threat to systems upon which the globe increasingly depends. It is more and more evident, one analyst suggests, that "reliance on space-based technologies ... means that any large-scale disruption to satellites such as solar superstorms could have significant consequences for electricity distribution, communications, navigation, logistics and weather forecasts".[62]

The negative consequences of such disruption are, according to the Union of Concerned Scientists, made even more plausible with the considerable increase in the number of satellites, and hence satellite debris, now orbiting the Earth.[63] Today the number is 1,300. The big players to date are the United States with 549 orbiting satellites, Russia with 131, China with 142, the United Kingdom with forty, and India with thirty-three. However, few doubt that those numbers will increase, and that the number of States with orbiting satellites will increase as well.[64]

With such dependence upon satellites and eventually a proliferation of "international space stations", national self-interests as well as the interests of others such as the private sector may increasingly be defined by their abilities to maintain control over their respective technologies, and conversely may well be defined by their abilities to limit the interference of others. As noted earlier, space

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60 Matthew Mather, "How Space and Cyberspace are Merging to Become the Primary Battlefield of the 21st Century", white paper, originally appearing in *Space Quarterly Magazine*, 15 March 2013.
61 D. R. Ward, above note 20, p. 5. According to the Defense Advanced Research Projects Agency, "The United States is reliant on space for virtually every essential security mission, but US space capacities have not kept up with rapid global changes."
62 NIC, above note 39.
63 David Wright, "The Current Space Debris Situation", Orbit Debris Mitigation Workshop, Beijing, 2010, available at: https://swfound.org/media/99971/wright-space-debris_situation.pdf.
64 S. Jones, above note 49.

power may well determine global power, and to ensure the latter, the former will become an increasingly contested arena.

One way that this plausible perspective could play out as a source of future conflict links cyberspace, outer space and what has been described as space "debris". The prospect of the debris of one country – intentionally or unintentionally – causing significant damage to the space-based cyber-systems of another could become a *casus belli*. Efforts of one country, for example, to control the source of another country's debris could result in hostilities in outer space or from outer space to the planet or *vice versa*. These sorts of tensions will in one way or another begin to explain the types of warfare which until recently had been the purview of science fiction.

This possible reality is already presaged by what are known as "ghost satellites", such as Kosmos 2499. These are intended to approach potentially debris polluting satellites of other countries for purposes of "inspection", and with the capacity to destroy them.[65] From a planetary perspective, this sort of destruction "would amount to a crippling blow on the function of communities all around the world, including diminishing the ability of military and government agencies to communicate efficiently in times of emergency".[66]

A second dimension of extra-terrestrial warfare will involve weapons placed in outer space designed to destroy Earth-bound capacities directly. One analyst foresees the aforementioned "rods from God", where a guidance computer directs a large object such as a tungsten rod from space, using the immense kinetic energy developed as an object falls from space to "take out", for example, "a rogue nation's deep underground facilities where illicit nuclear weapons development might be going on".[67]

In this context, it is all too plausible that the cyber-wars which will occur in outer space and the weapons systems that are launched from outer space to target specific planet-based systems will have consequences that will go well beyond the systems, territory and populations of those regarded as opponents. While the effects will not necessarily result in a "world war", they may result in "global attrition", where vast numbers of people will be seriously affected outside "the battle zone" due to the rapid spread, for example, of molecular nano-technology and related factors that could "eat up the biosphere".[68]

Uncertain asymmetries

War-making power in the international system has traditionally been reflected in the armouries of States. Power, *per se*, could be distinguished between those

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65 *Ibid.*
66 M. Beard, above note 50.
67 John Arquilla, "Rods from God: Imagine a Bundle of Telephone Poles Hurtling through Space at 7,000 mph", *SF Gate*, 12 March 2006, available at: www.sfgate.com/opiion/article/RODS-FROM-GOD-Imagine-a-bundle-of-telephone-2539690.php.
68 Nick Bostrom, "Existential Risks: Analysing Human Extinction Scenarios and Related Hazards", *Journal of Evolution and Technology*, Vol. 9, No. 1, 2002.

States that had quantitative and qualitative superiority in terms of weaponry and armed forces and those that did not. Yet increasingly, as noted by a number of strategists, there are more and more under-capacitated States attempting to assert their authority in various ways.

States traditionally regarded as "underdeveloped" or impoverished already have access to some of the world's deadliest weapons, such as nuclear and chemical weapons. As evidenced by the Pakistani nuclear expert A. Q. Khan, global smuggling networks can ensure that even the most seemingly powerless can become unwelcome members of the "nuclear club".[69] The weapons trade, by no means a new phenomenon, has grown significantly amongst those deemed to be weaker States. North Korea, for example, has had a long history of aggressively buying, marketing and selling arms, especially in developing countries in the Middle East, Africa, South-East Asia and Cuba. Much of that business has been in sales of short- and medium-range missiles. Though ostensibly the market for full missile systems is thought to have dried up in recent years, it is very evident that the trade in missile components continues to flourish.[70]

Hence, as one searches for the sorts of tensions that could eventually lead to conflict, one possibility concerns the challenge to assumptions about the capacities of "super" or "great" powers vis-à-vis those with supposedly less power. The implications of asymmetric power may well become less certain in a world that is more and more atomized and where access to a wide range of armaments is readily available. In an increasingly fragmented world, efforts by traditionally strong States to deal with such "uncertainties" could be relatively fruitless, and attempts to deal with seeming asymmetries may well lead to tensions that in turn could result in conflict.

In warfare, uncertain asymmetries have in many ways become a norm – a norm further reflecting the ability of relatively poor States to sustain their efforts to accumulate high-impact weaponry. In other words, in terms of duration, sustained support through a plethora of social networks and ever increasing sources of a burgeoning range of lethal weapons, a growing number of States – not merely "superpowers" – will be able to inflict existential violence internationally. This uncertain asymmetry will be further complicated by constant flows of equipment via 3-D and 4-D printing, resources via what was earlier described as cyber-cash, and cyber-intelligence and cyber-warfare, as well as biological and nano-technological agents. If one looks at these prospects, one significant difference between the present and the future is that conflict in the future will be able to be sustained even between conventionally perceived strong and weak parties in a variety of ways over hitherto unimagined reaches of time and space.

Resource competition and resource conflict

For a global population forecast by the United Nations to be approximately 9.7 billion by 2050, the availability of, and access to, a wide range and volume of

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69   BBC, above note 59.
70   "North Korea's Shadowy Arms Trade", *The Guardian*, 18 July 2013.

resources would seem essential, indeed vital. As noted in the section concerning transformative factors, the potential for finding new ways of capturing and harvesting food, water and minerals is truly revolutionary. On the other hand, the very access to such resources remains uncertain.

While both water and agriculture production will inevitably benefit from new technologies, the critical factor will be access and availability. That appears to be an increasing challenge. When it comes to food, the present situation may also reflect what might happen in the future, for according to the assessment of the US National Intelligence Agency,

> [t]he world is likely to continue to produce sufficient food supplies for at least the next 10 years, but food distribution will almost certainly remain uneven because tens of millions of people lack access to arable land or income sources to buy food.[71]

In the case of water, the UN has predicted that supplies of water shared by multiple countries could become an issue in the future, noting, for example, that the Nile alone travels through nine different countries.[72] Furthermore, "there are 215 'international' rivers and more than 300 water basins that are shared by multiple countries, all providing potential conflict zones as water resources are depleted". A shortage "represents a major political, economic, and human rights issue, threatening to amplify conflict, food insecurity, and poor health and sanitation",[73] and, as noted earlier, will also be reflected in mass displacement. In this context, the emerging tensions arising out of dam building, for example, along the Brahmaputra and the Mekong delta demonstrate the ecological, energy resource and political challenges faced in trans-boundary water networks.[74] Such tensions do not, according to a variety of sources, suggest that "water wars", for example between China and India, are imminent or foreseeable in the immediate future.[75] Nevertheless, the effects of climate change and its resource impacts over time may well see today's commitment to negotiation turn to resource conflicts.

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71 Office of the Director of National Intelligence, *Global Food Security*, Intelligence Community Assessment, ICA 2015-4, 22 September 2015.
72 UN Office for the Coordination of Humanitarian Affairs, Policy Development and Studies Branch, *Water Scarcity and Humanitarian Action: Key Emerging Trends and Challenges*, Occasional Policy Brief No. 4, September 2010.
73 *Ibid.*
74 Examples for the challenges of dam building along the Brahmaputra can be found in China Dialogue, Hazard Research Centre, University College London, and Humanitarian Futures Programme, King's College, London, *The Waters of the Third Pole: Sources of Threats; Sources of Survival*, June 2010, available at: www.humanitarianfutures.org/publications/the-waters-of-the-third-pole-sources-of-threat-sources-of-survival/. For the Mekong delta, see "Requiem for a River", *The Economist*, 13 February 2016, p. 47.
75 The tenor of the debate can be seen from two examples: a more peaceful resolution in Sudha Ramachandrum, "Water Wars: China, India and the Great Dam Rush", *The Diplomat*, 3 April 2015, available at: http://thediplomat.com/2015/04/water-wars-china-india-and-the-great-dam-rush/; and a more pessimistic view in Joel Wuthnow, "This River Could Sink China–India Relations", *The National Interest*, 19 April 2016, available at: http://nationalinterest.org/feature/water-war-river-could-sink-china-india-relations-15829.

Wars over resources will most likely be an ever more prominent feature in future conflicts. The effects that climate change, for example, might have not only on resources such as water and arable land, but on land itself, will inevitably be a "threat multiplier"; according to the US Defense Department's *2014 Climate Change Adaptation Roadmap*, "[r]ising global temperatures, changing precipitation patterns, climbing sea levels and more extreme weather events will intensify the challenges of global instability, hunger, poverty and conflict."[76] To that list, sources of energy and myriad forms of raw materials could be added to suggest why rising demands for materials and access to them will be growing factors in anticipating conflicts.

Yet, as one looks to the future, there may well be changes afoot that will transform not only the source and types of many resources, but also their location and access to them. As noted earlier, over the next quarter of a century, the issue of energy could be fundamentally transformed by technologies that would transmit solar energy directly to the planet in sufficient abundance to cover the needs of the planet's population. Similarly, the desalinization process – fuelled to a significant extent by direct solar transmission – would in principle be adequate to serve the needs of humankind. Mineral mining, too, could be increasingly dependent upon the massive resources found in outer space. All these resources, though seemingly beneficial to those on Earth, may well prove to be the source of resource conflicts in outer space in a generation's time.

Super-solar, for example, has been seen as an object of contention, because its potential universality would be perceived to be kidnapped and dominated by controllers who will alienate others. When it comes to extra-terrestrial mining, the US Congress passed the Space Act on 18 November 2015, and gave US space firms the rights to own and sell natural resources they mine from bodies in space, including asteroids. Some scientific observers saw this initiative as "the most significant salvo that has been fired in the ideological battle over ownership of the cosmos".[77]

War, in other words, could well result from efforts to protect the contending interests of "extra-terrestrial haves and have-nots". As with the efforts of contending forces to control outer space systems – noted earlier in the section "Cyberspace and Outer Space" – the conflict stemming from resource clashes will impact upon communities that go well beyond those directly engaged in war. The fact that such conflicts may take place will in no small part be due to the wealth and power that will accrue to the victors – but also, on a different level, it will be due to the fact that there may well not be any internationally recognized legal constraint on such potential resource monopolies.

Transcendent health threats and conflict triggers

In 2012, the World Food Programme (WFP) held a workshop in Johannesburg, South Africa, for Southern Africa Development Community governments'

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76   US Department of Defense, *2014 Climate Change Adaptation Road Map*, 13 October 2014.
77   Reference to Thomas Homer-Dixon in Michelle Bentley, *Weapons of Mass Destruction and U.S. Foreign Policy: The Strategic Use of a Concept*, Routledge, London, 2014, p. 121.

ministries of planning. The objective was to support planning ministries' efforts to enhance their strategy formulation capacities. In anticipation of the workshop, the ministries and WFP chose to use pandemics as a case study. Participants included a wide range of private-sector participants as well as governmental, international and non-governmental organizations, and leading the process was the United States Africa Command (Africom). The private sector's participation reflected its belief that a pandemic as well as efforts to deal with it would cripple its businesses. As for Africom, representatives explained their participation in terms of "a direct threat to the security of the United States".[78]

The plausible threat of "super-bugs" is regarded as a major global concern, particularly as antibiotics seem unable to keep pace with the rapid growth and transformative speed of viruses. In the United States alone, drug-resistant bacteria infect more than 2 million people annually, and kill 23,000 of those affected, according to the US Center for Disease Control and Prevention. The Ebola crisis was for all intents and purposes contained within six West African countries, and the death toll was officially reported by the World Health Organisation (WHO) to be 11,316. Yet, amongst the lessons learned from this almost two-year episode was that "what began as a health crisis snowballed into a humanitarian, social, economic and security crisis. In a world of radically increased interdependence, the consequences were felt globally."[79]

Similarly, soon after the official end of the Ebola crisis, a new threat emerged, namely the Zika virus. It began to move from Brazil northwards, moving through South America into North America. At the beginning of February 2016, the European Centre for Disease Control announced that the virus was moving into the Pacific, and that it had now become an issue of "international concern".[80]

These events suggest the prospect of emerging "super-bugs". In a rapidly increasingly interconnected world, the issue of how State authorities will deal with the looming threat of such viruses "crossing borders" will become central to States' interests and authority. WHO hopes that States will recognize the importance of transnational cooperation to address the threat at source. However, there is also the prospect – as evidenced in the first stages of the Ebola and Zika viruses – that States may "hide" or downplay such issues for a variety of reasons, including protecting their tourism industry. To what extent would such obfuscation challenge the interests of other States? The closing of borders, the severing of trade links, and demands made on States deemed to be the source of such potential catastrophes could ultimately create an environment which will not meet the aspirations for cooperation that WHO feels to be so essential.

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78 This statement was made in response by a member of the Africom Team to this author's question during the Southern Africa Development Community workshop.
79 WHO, "Ebola Response: What Needs to Happen in 2015", January 2015, available at: http://www.who.int/csr/disease/ebola/one-year-report/response-in-2015/en/.
80 See European Centre for Disease Prevention and Control, "Zika Virus Infection", available at: http://ecdc.europa.eu/en/healthtopics/zika_virus_infection/Pages/index.aspx#sthash.I0I8ZVNx.dpuf.

It is not irrelevant in this context that a number of military establishments are developing broad capacities for dealing with disease. In this context,

> the military is likely to have a greater capacity to identify engineered diseases and potentially devastating natural diseases … than civilian agencies. The military has prepared its own personnel to face such weapons in a way that civilian agencies have not. Furthermore, it may be the only institution with the necessary technology, resources, and manpower to be able to effectively counter an attack – or a pandemic disaster.[81]

The potential threat of pandemics, be the sources natural or manmade, will inevitably become a major security threat around the world. The emphasis that many States are already giving to protecting their borders from disease and carriers of disease is increasingly evident. When it comes to defining wars of the future, a concomitant issue is the extent to which military engagement outside national borders will be used to eradicate pandemic threats. Or, in a related vein, to what extent might cyber-systems be used to eradicate the sources of such pandemics without the agreement of the States from which the disease stems?

It is very likely that attempts to deal with pandemics in the future will resemble ways that have emerged in recent years to deal with terrorism. Increasingly, efforts to eliminate the latter have resulted in conflicts regarded as "borderless", unpredictable and prone to extraordinary speed of change. The inherent danger to large portions of a State's population may lead its government to regard the inaction or inadequate action of "offending States" which fail to address a pandemic as an aggressive act. Intrusive surveillance may be one step in the direction of escalating hostilities, followed by virtual or physical intervention. The military may impose buffer zones between its borders and those of the offending State. More likely, it will restrict a wide range of activities affecting, for example, trade and transport that could well cripple the economic and security viability of the offender.

In and of itself, these acts might well be seen as a violation of the sovereignty of a State. The consequences of such perceived violations may go beyond that immediate target and cascade into the economic and security interests of other States and other groupings. What initially began as protective measures against the source of a particular pandemic, or "natural threat", could spill over into economic and security threats for a wider range of countries. That larger group may well have no choice between pandemic threats and so-called "synchronous failures", or crises that can propagate across multiple system boundaries even on a global scale.[82]

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81 Laura K. Donohue, "Pandemic Disease, Biological Weapons, and War" in Austin Sarat, Lawrence Douglas and Martha Merrill Umphrey (eds), *Law and War*, Stanford University Press, Stanford, CA, 2014, p. 8.
82 Brian Walker, *et al.*, "Synchronous Failure: The Emerging Causal Architecture of Global Crisis", *Ecology and Society*, Vol. 20, No. 3, 2015.

Organizational paralysis and future sleepwalkers

According to a growing number of analysts, policy planners and decision-makers have all too often "become collectively short-sighted", succumbing to a kind of "future blindness" in which potential implications of transformative change and complexity are ignored.[83] Today, a considerable number of organizations and certainly those found in most governmental bodies are deemed to be relatively insensitive to substantive change. As organizations, they have been described as inherently linear, siloed and reductionist in approach when it comes to defining problems and solutions.

"Team of teams", "Teal organizations"[84] and "competitive collaboration" are just a few terms which suggest that the days of secure control of "the product", the innovation, "the secret" and stove-piped specializations will not endure.[85] Mechanisms will increasingly be needed that are able to integrate information and respond to a fluid external environment beyond the capacities of conventional organizations. Increasingly, the sheer speed of and access to information and the interdependence of the modern environment leave little time for the structuralist construct. For highly complex problems to be solved, "shared consciousness" – i.e., extremely transparent information sharing – and "empowered execution", pushing decision-making and ownership to the right level for every action, will reverse that construct.

And yet, it seems unlikely that governments will go down that route, either willingly or with any alacrity. There will of course be organizational adjustments on the margins. However, the very nature of the organization may well not adequately adapt – until much too late – to the types and speed of transformative changes that will mark the foreseeable future. Rather than the sorts of sensitive and adaptive capacities required to address new types of situations, the machinery of State may all too often interpret the new through the lens of the old. Here, too, might be a source of significant tension, for organizations as presently configured could quite plausibly misinterpret the nature and intent of threat in a rapidly changing socioeconomic and political environment. All too often, an appreciation of complexity, exploration of alternative measures and efforts to go beyond standard operating procedures fail to go beyond the "comfort zone".[86]

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83 Farhad Manjoo, "Why We Need to Pick Up Alvin Toffler's Torch", *New York Times*, 6 July 2016.
84 Teal organizations are based upon the ability of an organization's staff to self-organize and self-manage in order to achieve the overall purpose of the organization. Rather than a hierarchical "plan and control" structure, the Teal structure consists of small teams that determine how best the team can achieve abiding organizational goals and how best individual team members can do so. It is a structure marked by its fluidity and adaptive capacities. The concept of the Teal organization can be found in Frederick Laloux, *Reinventing Organisations: A Guide to Creating Organisations Inspired by the Next Stage of Human Consciousness*, Nelson Parker Publishers, Brussels, 2014.
85 Stanley McChrystal, *Team of Teams: New Rules of Engagement for a Complex World*, Portfolio/Penguin, New York, 2015.
86 Some of these sorts of concerns were mirrored in the UK's *Iraq Inquiry* report, referred to as the Chilcot Report, concerning decisions which led to the invasion of Iraq and subsequent post-war action. The report was presented on 6 July 2016. Committee of Privy Counsellors, *The Report of the Iraq Inquiry*, report, HC 264, 6 July 2016.

In explaining the uncertain steps with which Europe bumbled into the First World War, Christopher Clark suggests that "given the inter-relationships across the system, the consequences of any one action depended on the responsive actions of others, which were hard to calculate in advance, because of the opacity of decision-making processes".[87] In that war as well as in subsequent conflicts, all too often the already narrow focus of institutions about threats and appropriate responses has narrowed even further as tensions increased. Screening out information perceived to be irrelevant intensifies. Secrecy adds to the opacity of decision-making, and "group think" ensures that unpalatable ideas, or deviations from organizational norms, are marginalized.

Organizational repertoires and standard operating procedures could create tensions by appearing to outsiders to be insensitive to changing contexts. As one looks to emerging conflicts, there is also the paradoxical prospect that organizations may attempt to deal with complexity by bringing in ever greater numbers of experts, who may not have the desire or opportunities to integrate their respective expertise. Despite the proliferation of expertise, threats are not viewed in a holistic manner. Rather, they remain in the silo responsible for response, but lacking a full appreciation of context and changed circumstances.[88] It is not irrelevant that in a 2013 analysis of the ways governments use "foresight analysis", the general conclusion was that

> [t]he case of the military foresight programmes in some countries is quite illustrative .... While there is some cooperation between military and civilian foresight projects, military foresight programmes in countries such as the UK, Canada, the US and Norway remain quite separate from work in other government departments. Cooperation is often limited among different sections of the military in these countries.[89]

Modern history is riddled with examples of wars that have ensued because of the limited perspectives that organizations bring to analysis and response. The old adage that "generals always fight the last war" is all too appropriate as one considers not only how wars will be fought, but how they will occur. A former US secretary of defence, deeply concerned about the prospect of nuclear war in the future, noted:

> Our chief peril is that the poised nuclear doom ... is too far out of the global public consciousness .... And for many it would seem to be the keeping of faith that nuclear deterrence will hold indefinitely – that leaders will always

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87 Christopher Clark, *The Sleepwalkers: How Europe Went to War in 1914*, Penguin, London, 2012, p. 555.
88 In this context, Professor Martin Rees quotes the long-time scientific adviser to the UK government, Solly Zuckerman, saying that "the basic reason for the irrationality of the whole process [of the arms race] ... was shaped by technologists, not because they were concerned with any visionary picture of how the world should evolve, but because they were merely doing what they saw to be their job". Martin Rees, *Our Final Century: Will the Human Race Survive the 21st Century?*, Basic Books, London, 2003, p. 32.
89 Iana Dreyer and Gerald Stang, "Foresight in Governments – Practices and Trends around the World", *Yearbook of European Security*, 2013.

have accurate enough instantaneous knowledge, know the true context of events, and enjoy the good luck to avoid the most tragic of miscalculations.[90]

Are we ready?

At the outset of this article, it was suggested that devising future war scenarios was far easier than trying to answer the question, "Are we ready for them?" Readiness has many dimensions in this context. The assumptions underlying *Realpolitik* and power politics suggest that anticipating the future of war will, as in the past, rely on rational choice, or at least "bounded rationality",[91] and supposedly rational behaviour. Yet, if one looks at assumptions that can safely be made about organizational behaviour (an issue referred to in previous sections) and institutional dynamics, the question about our state of preparedness for dealing with "the future of conflict" becomes far more complex.

In a related vein, the issues of organizational behaviour and institutional dynamics also relate to how the legal parameters that ostensibly are intended to constrain or at least limit the full impact of conflict are developed. In other words, to what extent do the legal frameworks that we have to date need to be adjusted to deal with the future, and to what extent are the organizational and institutional systems in place adequately responsive to transformative change?

An additional way to seek answers to the question about readiness should include the extent to which there is public awareness about such future threats. This poses a very difficult balance between the consequences of public debate and the sorts of fears, concerns or disinterest that it engenders. It reflects the ways that such debates are generated and guided, and these, too, take us into the realm of organizational and institutional behaviour.

Organizational constraints

Earlier in this analysis, organizational paralysis in various forms was cited as one of seven dimensions of tensions and causes of conflict. Here, organizational dynamics emerges once again as a major feature, only in this context, it is the extent to which such dynamics affect "our readiness". The challenge for the organization in this context – be it governmental, inter-governmental or non-governmental – revolves around its perspectives, information gathering and decision-making. And while such factors may indeed differ in different organizations, there are themes that have general relevance to most organizations.

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90 William J. Perry, *My Journey at the Nuclear Brink*, Stanford Securities Studies, 2016, as quoted in Jerry Brown, "A Stark Nuclear Warning", *New York Review of Books*, 14 July 2016, p. 11.
91 See Herbert Simon, "Rational Decision-Making in Business Organizations", *American Economic Review*, Vol. 69, No. 4, 1979. In the article, Simon describes the dimensions of "bounded rationality", where individuals make rational decisions, though limited by the available information, the tractability of the decision problem, the cognitive limitations of their minds, and the time available to make the decision.

In a recent study entitled *Thinking the Unthinkable*, the authors refer to a comment made by the deputy governor of Russia's Central Bank about "why unthinkables are not thought about". Referring to the prospect of a total collapse of Russia's economy, the deputy governor stated: "I couldn't imagine even a year ago that such a thing would happen even in my worst nightmare."[92] In response to this, the authors note:

> This kind of executive astonishment at unexpected events now permeates much of public and corporate life globally. Increasingly it is reasonably labelled by many leaders as shock because of the unexpected scale and nature of what has happened. In what many describe as a "scary new world", they ask if they should have seen the events coming, and if they did not see – then why not?[93]

Capacities to anticipate and adapt to rapidly changing circumstances are crucial for dealing with escalating conflict, but also possibly for ways to mitigate the chances of it occurring in the first place. Organizations, however, saddled with their silos, devices to screen out "unrecognizable information" and standard operating procedures, all too often lack what is needed to sense the tensions that could generate wars. The integrated information and multi-sectoral perspectives that could enhance the ability of an organization to be more anticipatory and adaptive is sacrificed to resistance to change.[94]

Decision-makers and policy planners are all too reluctant to go beyond the immediate, the world described as their "comfort zones". "For public-sector officials, often the challenge isn't lack of vision but short time frames, competing priorities, and flawed delivery."[95] Even for those willing to speculate about the future, there is a reluctance to do so if it might antagonize potential supporters and funders. All too often, innovations and innovative thinking are introduced only as desperate alternatives to failing systems rather than as well-considered and applied transformations. To some extent this explains why even when faced with factors that clearly have transformative potential, incremental adjustments frame the response.[96]

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92 Nik Gowing and Chris Langdon, *Thinking the Unthinkable: A New Imperative for Leadership in the Digital Age*, Chartered Institute of Management Accountants, London, 2016, p. 10.
93 *Ibid.*
94 In a 2015 report on *The Future of Global Conflict: Trends and Challenges towards 2040*, it was noted that "large state organisations and the international community have co-opted the language of critique, creativity and innovation without fundamentally altering their organisational logic". Wilton Park Report WP 1374, in association with the UK Ministry of Defence and the Department for International Development, 18 February 2015.
95 Richard Dobbs, James Manyika and Jonathan Woetzel, *No Ordinary Disruption: The Four Global Forces Breaking All the Trends*, Public Affairs Books, New York, 2015.
96 A case in point were the parliamentary debates in the United Kingdom over the period of 2015–2016 concerning the renewal of the submarine-based Trident nuclear system. While the debates in Parliament and throughout much of Whitehall had immediate political and economic interests for various constituencies, it was a debate that nevertheless was about a system that would take twenty years to finalize, and one which in twenty years would be readily surpassed, for example, by extraterrestrial capacities.

As we prepare to deal with the threats of future wars, there is a need to ensure that organizations responsible for assessing threats and appropriate responses have the capacities and incentives to do so that go beyond standard operating procedures. They have to be more anticipatory and adaptive, spurred on by an ethos of thinking in new and more innovative ways. They have to "embrace complexity"; they have to see the present differently by being encouraged to make their assumptions explicit, and in so doing to have a better idea about "the different kinds of futures we use when make decisions".[97]

Analysts with experience of the public and private sectors see the need to restructure the traditional organization in various ways. It is essential in a world of rapid change and complexity to remove organizational silos, challenge preconceived standard operating procedures and promote more integrated situation analysis and responses at "appropriate levels", not determined by hierarchical structures.[98] One way of doing this has been suggested by "complexity theorists", who look at issues through the lens of the "co-evolutionary dynamics" that determine a problem's key interacting issues. Problems and solutions begin with accepting that a problem, *per se*, consists of many elements, each element continuously influencing the other. It is from an appreciation of this dynamic interchange that one can identify ways – *viz*, an "enabling environment" – that will enable one to understand the root of the problem and ways to address it holistically.[99]

McKinsey & Company, the worldwide consultancy firm, also recognizes the innate hazards of overly structured organizations. It urges global-oriented organizations of the future to be more "process-centric", to allow business units to tailor their organizations to local conditions, to bring diverse participants into the strategy creation process and to foster peer-to-peer collaboration. In a telling conclusion, one McKinsey analysis notes that "opportunities for organisational innovation will present themselves, and those companies able to recognise and willing to embrace them will gain huge competitive advantage by doing so".[100]

This conclusion is a lesson to all, and certainly to those who are asking whether they are ready for wars in the future. By no means are more adaptive and anticipatory organizations in and of themselves the answer, but they are one crucial element in sensitizing decision-makers and planners to the changing nature of threats, and proffering more timely analyses and solutions.

97 Riel Miller, "Futures Literacy – Embracing Complexity and Using the Future", *Ethos*, No. 10, October 2011, p. 25.
98 F. Laloux, above note 84.
99 Eve Mitleton-Kelly, *Complex Systems and Evolutionary Perspectives on Organisations: The Application of Complexity Theory to Organisations*, Pergamon, Advanced Series in Management, London, 2003.
100 Wouter Aghina, Aaron De Smet and Suzanne Haywood, "The Past and the Future of Global Organizations", *McKinsey Quarterly*, September 2014.

Institutional rivalries

The former US secretary of defence, Robert Gates, recounts the difficulties he had in 2010 in dealing with the United States' "vulnerability to cyber attacks on the computers so vital to our critical infrastructure". Despite all the efforts which this powerful figure in President Obama's administration had made, there were contending institutional interests that seriously delayed a coherent solution to this major security issue. Disputes arose between the government and the private sector about who should be in charge – for example, the government or business, the Department of Homeland Security or the Defense Department's National Security Agency? Myriad players joined the fray to deal with the issue, but their institutional perspectives hampered any resolution of an issue that was deemed to be so vital to the security of the nation. "I was still waiting for an answer to that question three years later", remarked Gates towards the end of his assignment.[101]

Time and time again, whether it be the 1962 Cuban Missile Crisis or the more recent war in Iraq, institutional interests and perspectives determine not only what responsible institutions see as threats, but the way such threats are handled.[102] While such inter-institutional disputes are understandable, they can nevertheless hamper rational and coherent outputs and all too often result in compromises reflecting the lowest common denominator. In a foreseeable future world where complexity, institutional overlap and speed of change will be an emerging norm, institutional competition may well prove to be another hindrance to anticipating and possibly mitigating the consequences of wars. Clearly this spills over into international organizations, where it has been noted that

> collaborations between bureaucracies within a state are notoriously difficult and costly: effective international responses to conflict will require coherence between multiple state bureaucracies that follow divergent cultural, linguistic, and organisational logics. The cost of internationalisation could theoretically be even greater than the cost of individual state action.[103]

There is a well-developed history of efforts to address such inter-institutional behaviour and its consequences. From "adhocracy"[104] to "mission-focused networks", from "Teal structures" to "team of teams", considerable and continuing efforts are made to get organizations to loosen their institutional protective walls and to recognize the mutuality of their cross-institutional interests. While most in

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101 Robert M. Gates, *Duty: Memoirs of a Secretary at War*, W. H. Allen, London, 2014, p. 449.
102 See, for example, Graham Allison and Philip Zelikow, *Essence of Decision: Explaining the Cuban Missile Crisis*, 2nd ed., Longman, New York, 1999; and S. McChrystal, above note 85.
103 Wilton Park, above note 94.
104 Robert H. Waterman Jr. defined adhocracy as "any form of organization that cuts across normal bureaucratic lines to capture opportunities, solve problems, and get results". For Henry Mintzberg, an adhocracy is a complex and dynamic organizational form. It is different from bureaucracy; like Alvin Toffler in *Future Shock*, Mintzberg considers bureaucracy a thing of the past, and adhocracy one of the future. Adhocracy is "very good at problem solving and innovations, and thrives in a changing environment. It requires sophisticated and often automated technical systems to develop and thrive." See the definition of "Adhocracy" on Wikipedia, available at: http://en.wikipedia.org/wiki/Adhocracy.

government would probably recognize the problem, little has been done to ensure on a continuing and consistent basis the sort of interactive information sharing that is fundamental to understanding different types of emerging tensions and their resulting conflicts.

That said, there is a reality that may well transform – for better or for worse – inter-institutional competition. That reality takes the reader back to what earlier in this article was referred to in the heading "Transformative Agents and Global Implications". Conventional institutional barriers may not be sustainable in a world of surveillance and sousveillance, where all is known about all throughout society. Access to big data and artificial intelligence may enable organizations to gather, analyze and structure information that makes conventional institutional barriers of less relevance. Yet here, too, the reality of such transformations remains unknown, and preparedness for anticipating and dealing with wars of the future may still be constrained by standard patterns of institutional behaviour. Hence, the immediate challenge is to ensure that the right people, those who can offer different understandings and explanations of plausible future tensions and conflicts – whatever their institution or sector – are sitting at the same table.

One step in that direction is emerging from initiatives to promote "competitive collaboration". Though institutional competition may be seen as a fact of life, the complex, multidisciplinary problems that many organizations attempt to tackle do not have easy fixes. To deal with such problems requires continuous learning and innovation and the use of real-time data to help understand what is and is not working. Organizations faced with this conundrum have, broadly speaking, two choices. They can either guard information closely, blocking out its perceived advantage from others; or alternatively, share the information with others as part of an appreciation that others, in turn, will have to share their information with them. Beyond that, "leaders and organizations are acknowledging that even their best individual efforts can't stack up against today's complex and interconnected problems. They are putting aside self-interests and collaborating ... to advance their shared objectives. It's called collective impact and it's a growing trend."[105]

Once again, greater inter-institutional understanding and collaboration are not in and of themselves the answer for testing one's readiness for what the future might hold. They are, however, ways in which the nature of a problem – in this case, threats – can be better understood, and more cohesive, integrated solutions more effectively devised.

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105 Ben Hecht, "Collaboration is the New Competition", *Harvard Business Review*, 10 January 2013. In a related context, a former chair of the British Standards Institute's Knowledge Management Statistics Committee, Ron Young, noted in a presentation concerning "Competitive Collaboration in a Global Knowledge Economy" (Abu Dhabi, 15–16 March 2011) that the real purpose of a European Commission-initiated project across European companies was not "the deliverables", but was rather to set up projects to get organizations in different countries across Europe to collaborate. "We learned so much from this EC project about the power of effective virtual cross functional collaborative team work."

Legal gaps

Organizational behaviour and institutional rivalries may also play roles in allowing gaps to emerge in international law – gaps that could ultimately lead to conflict. In no sense is this to ignore the fact that political calculus is ultimately the determining factor when dealing with, *inter alia*, international law. However, both organizational behaviour and institutional rivalries might well explain the short-term perspectives of organizations and their inability to develop consensus on issues of potentially life and death importance. A relevant scenario, as described by Matthew Beard, suggests a series of escalating tensions between Japan and China concerning the ownership of the Senkaku and Diaoyu islands in the East China Sea, where little effort appears to have been made to adjust laws to changing circumstances:

> the Chinese position warships in Japanese territorial waters. In response the United States intervenes on the side of Japan, *positioning orbital weapons* above China as a means of encouraging the withdrawal of Chinese warships from Japanese waters. Eventually, Japan asks the United Nations to order sanctions on the Chinese incursion, whilst China requests the United States be sanctioned for violating its sovereignty through the use of military coercion.[106]

A very fundamental issue which this scenario points to is that any object, under present international law, is free to move unimpeded around the Earth or anywhere else. "The fact that states cannot claim sovereignty over a particular region means that states can permissibly station weapons within immediate striking distance of other states without violating the letter of the law with regard to state sovereignty."[107] The extent to which that legal loophole could lead to tensions which in turn might lead to war is clearly an open question. Yet, the point here is the extent to which legal frameworks keep apace with the changing dimensions and dynamics of plausible sources of conflict. In a related vein, another relevant example concerns the use of drones for military purposes. As is becoming increasingly evident, some of the major implications of that technology were not adequately identified or considered in the context of some of the most basic provisions of international humanitarian law. To what extent do drones change the very nature of the field of battle, to what extent do they complicate the issue of targeting military objects, and what are the legal responsibilities of drone "pilots" operating many thousands of miles away from their targets?[108]

All this would seem to confirm the remark of an astute observer who had served at senior levels within the British government: "On more traditional issues the world has been sluggish when it comes to translating intentions into

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106 M. Beard, above note 50. Emphasis added.
107 *Ibid.*
108 See "Extrajudicial Killing and Drones" in 'Drone Strikes and International Law: Fallout Reaches the Ivory Tower", *The Economist*, 22 April 2015. See also Peter Maurer interview, "The Use of Armed Drones Must Comply with Laws", ICRC, 10 May 2013, available at: www.icrc.org/eng/resources/documents/interview/2013/05-10-drone-weapons-ihl.htm.

actions."[109] This appears to be clearly the case for the international community to date, and in an agenda intended to prepare for future wars by eliminating or at least reducing their impacts, greater efforts need to be made to identify what legal gaps need to be filled. That said, in the words of an expert concerned with the interface between bureaucratic and institutional behaviour and international law, "Government bureaucracies are notably status-quo oriented organisations, wherein caution and conservative approaches tend to overshadow creativity and adventurism in policy-making."[110]

As the international community finds itself in a world facing ever increasing and ever more complex potential conflict drivers, it is more than likely that the framework of international law needs to be both more anticipatory and more integrated. For the former, much greater attention has to be given to the ways in which potential legal requirements are anticipated, and this would require far more active interaction between the sciences and between governments, including the military and international governmental and non-governmental organizations. As for the latter, greater integrated international legal frameworks, far greater attention has to be given to the complexities, what has been described as "the messes",[111] that spill over into related issues. There needs to be a far more active and overt commitment to making international law more sensitive to emerging threats. This is not to argue the case that international law, *per se*, is the ultimate solution for being ready to deal with plausible wars of the future. Rather, it is to stress the importance of engaging in a process that awakens decision-makers and policy planners to ways of anticipating and framing future challenges such as the threat of war.

Public awareness and the essential debates

"The public narrative [about conflict] requires constant attention and must be authentic and at least somewhat rational", stressed participants at a February 2015 conference that included senior military experts as well as government policy-makers.

> For example, why are some states trying to convince the public to increase defence spending while simultaneously arguing that there are few military answers to international problems …? But even while recognising the inherent tensions, contradictions and complexities of responding to global conflict, organisations such as the United Nations and European Union

109 Geoff Mulgan, *The Art of Public Strategy: Mobilizing Power and Knowledge for the Common Good*, Oxford University Press, Oxford, 2009, p. 56.
110 Christopher Joyner, *International Law in the 21st Century: Rules for Global Governance*, Rowman & Littlefield, New York, 2005, p. 119.
111 "A mess is a system or complex and dynamically interacting web of ill-defined or wicked problems, conundrums, paradoxes, puzzles, crises and their solutions, as well as the stated and understated, conscious and unconscious assumptions, beliefs, emotions and values that underlie these problems and solutions." Can M. Alpaslan and Ian I. Mitroff, *Swans, Swine, and Swindlers: Coping with the Growing Threat of Mega-crises and Mega-messes*, Stanford University Press, Stanford, 2008, p. 169.

should resurrect some transformative zeal. International organisations need to restart the magnetic power of globalised norms and be confident.'[112]

When considering plausible tensions that could result in conflict, one theme that emerged was the paradox between the remoteness of instruments of war and their potential all-encompassing impacts. In one sense, both are reflected in the emerging poison gas capacities of States towards the end of the nineteenth century. As opposed to conventional armaments, poison gas and its implications were not fully appreciated by the public at large, though its potential impact made little distinction between civilian and military.[113] A second and related theme that is also of considerable importance when considering public awareness is that violence has become so remote. Though the impact of conflict could be of existential consequence, virtual games and the remoteness of instruments of violence, such as drones and orbital weapons, are indicative of the gap between public perception and reality. A lack of appreciation of the causes and possible consequences of conflict needs to be overcome by more effective public narrative. There is little sign that governmental, inter-governmental and non-governmental organizations have been inclined to do so. There is a narrative lacking, and yet, the sheer complexity of war as well as existential threats needs to be understood globally.

In looking for ways to promote public awareness about the nature of future wars and their consequences, one automatically confronts the contradictions inherent in raising awareness – the tension in this case between increasing defence capacities and expenditures while underscoring the point that there are no military answers to international problems. And the call to "resurrect some transformative zeal" opens up yet another contradiction: in a world in which the volume and speed of information is unprecedented and will probably increase exponentially and be accessible to all, information disrupters – the multiplicity of networks – may generate more confusion than coherence.

In no sense, however, should this spectre diminish the importance of generating that narrative. This article will not attempt to suggest how that narrative could be developed and promoted. It will, however, stress three issues: the source of ideas that could lead to that narrative, emerging focal points to generate that narrative, and the message itself.

Despite the potential problems posed by information disrupters, one also has to recognize that new ideas, social concepts and political philosophies diffuse very rapidly without regard for physical distance, or even the social circumstances where they arise or are received. In this sense, what has been called the "global village" is open to all ideas. Perhaps over-optimistically, one could say that only their intrinsic power as ideas now matters.[114] This hope would seem to be

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112 Wilton Park, above note 94.
113 See, for example, Peter Sloterdijk, *Terror from the Air*, trans. Amy Patton and Steve Corcoran, MIT Press, Cambridge, 2009.
114 David Mercer, *Future Revolutions: A Comprehensive Guide to Life and Work in the Next Millennium*, Orion Business Books, London, 1998, pp. 172 ff.

reflected in the perspectives of two senior Google executives who assume that "digital empowerment will be for some the first experience of empowerment in their lives …. As a result, authoritarian governments will find their newly connected populations more difficult to control, repress and influence."[115]

The prospect of being able to propagate new ideas that transcend traditional institutional and political screening devices raises the likelihood that the promoters of new ideas will change. The atomized society may on the one hand generate fragmentation, but on the other serve as a channel for stimulating, alerting and persuading a much wider range of potentially interested parties than ever before about new ideas. In this context, even as early as the first Rio conference on the environment in 1992, a number of observers felt that "Greenpeace carries more weight than most nations!"[116] Now the reach of social networks and new forms of education through cyber-systems, for example, will become not only the conduits but also the creators of new ideas.[117]

With all the plethora of communications systems and sources for compelling narratives, what actually is "the message"? The message has to be framed around the fundamental change in the future of warfare, namely, that its effects can no longer be regarded as isolated phenomena, restricted within particular demographic and socioeconomic boundaries. Whether conflicts will be those described in the third section of the article, above, or others, the emerging reality is that warfare of the future will be bound neither by time nor space. It will spill over from its initial sources and will always be global in impact and consequences. The proposed narrative has to be underpinned by the emerging reality that the threats arising from future warfare will have no winners or losers, but only the latter. Mutual self-interest is the message.

Conclusion

Looking to the future of warfare from a two decades perspective, one cannot help but emphasize the transformative impact of technologies – known knowns and unknown unknowns. These will in so many ways define the sources of conflict as well as the means to pursue it. This is not to suggest that psychological, social psychological, cultural and societal factors will not also be determinants of wars in the future, but even those factors will ultimately be affected by the capacities provided by emerging technologies.

Despite the grim scenarios of the causes and consequences of future warfare proposed in this article, the prospects of them occurring are not inevitable. Certainly, elements of such portraits seem plausible; and, as descriptions of the future of warfare, all the relevant transformative elements that have been

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115 Eric Schmidt and Jared Cohen, *The New Digital Age: Reshaping the Future of People, Nations and Business*, John Murray, London, 2013, p. 7.
116 D. Mercer, above note 114.
117 Additional examples can be found in Roger Bourke White Jr, *Visions of 2050: Rise of the Cyber Muses*, Author House, Bloomington, 2015.

discussed are clear possibilities. However, as this article also concludes, there are some very practical ways to possibly mitigate some of the worst aspects of these scenarios. They by no means cover the full and very wide spectrum of ways to prepare to deal with warfare of the future. On the other hand, they do focus on a few issues that always seem to arise in various ways when reflecting on the history of warfare.

One begins with the importance of decision-makers, policy planners and their organizations becoming more anticipatory – bringing together a wide range of specializations to analyze and anticipate the sorts of complexity that clearly will underpin warfare in the future. They need to look for ways to reduce institutional rivalries that have in the past triggered the wrong reactions for the wrong reasons, and may well do so in the future. As a reflection of the need for greater anticipation and reduction of institutional rivalries, more effective international legal frameworks could well be a test of both. Ultimately, however, it is greater global awareness of the prospects and consequences of warfare in the future that this article suggests might prove to be the saving grace.

These suggestions, though few, are posited to ask not only if we are prepared, but also if we want to be so.