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**Humans Made Obsolete in Robotics  
Warfare**

By ME6 Vincent Chan

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# HUMANS MADE OBSOLETE IN ROBOTICS WARFARE

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## ABSTRACT

This essay examines the applications of robots in future wars and analyses the possibility of totally removing humans from war. Robots can enable unmanned warfare to complement areas where human capabilities are limited. The shift from industrial war to Low-Intensity Conflicts (LIC) also favours the deployment of robots. But, there are substantial counter-arguments raised against the proliferation of war robots. These include high-profile incidents of catastrophic unmanned system failures pointing to the limitations of current robotic technology as well as the increasingly blurred line between unmanned weapon systems and conventional weapons. Beyond technical and tactical constraints, there are also moral and ethical issues on the deployment of weaponised robots. This essay therefore posits that humans will not be obsolete in robotics warfare.

Keywords: *Unmanned; Artificial Intelligence; Robotics; Autonomous; Asymmetric*

## INTRODUCTION

Carl Von Clausewitz reminded us that ‘no one in his senses ought to start a war without first being clear in his mind what he intends to achieve by that war, and how he intends to conduct it.’<sup>1</sup> This illustrates that the purpose of war is conceptualised in one’s head before it is materialised in reality. Therefore, it is unlikely that one can remove ‘war’ from the ‘human’ since he is the initiator of war. The converse of removing the ‘human’ from ‘war’ is probably more conceivable. Then again, is it?

This essay posits that humans will not be obsolete in robotics warfare. Rather, humans have to play a more significant role in future wars. In this essay, ‘robots’ shall be broadly referred to as fully or semi-autonomous machines capable of performing complex functions. This assertion will be substantiated by examining the applications of robots in future wars and analysing the possibility of totally removing humans from war. It will first cover the range of functions performed by current war robots and their added value to the war effort. Secondly, it will project into the future and examine how new robotics technology can be deployed. It will also discuss how the shift from industrial war to LIC favours the deployment of robots. The counter-arguments will be set in the third section of the essay, describing the constraints where robots cannot be left

to operate independently. Finally, it will discuss the morality aspect of weaponising robots.

## ROBOTS IN MODERN WARFARE

*“The greatest revolution in military affairs since the atom bomb was the advent of robotic warfare.”*

- M. Shane Riza, Author of *Killing Without Heart*<sup>2</sup>

The proliferation of robotics technology in the battlefield is not only extensive, but the rate of its pervasiveness is astounding.<sup>3</sup> More than 7,000 robotic systems were deployed in Iraq and pilots in Nevada were remotely killing terrorists in Afghanistan.<sup>4</sup> Besides Unmanned Aerial Vehicles (UAV), robotic systems were deployed commonly in mine-clearing, explosive disposal, wide area search and extended surveillance. Categorically, military robots are most valued in ‘3D’ missions (i.e. Dull, Dangerous, Demanding), where they aid in reducing human fatigue for relatively straight forward tasks, reduce the risk exposure of the soldiers and enable them to sense-make better, move faster and last longer.

The changing texture of warfare and the price placed on war casualties since World War II (WWII) have also favoured robot deployments in modern wars. Sir Winston Churchill, in his inaugural ministerial speech,



*Attendees of the Singapore Defence Technology Summit on June 2018 viewing one of DSO National Laboratories' ongoing projects — the V15 UAV (foreground).*

declared for 'victory at all cost' for WWII.<sup>5</sup> Contrast this with General Sir Rupert Anthony Smith's observation that states have placed a higher premium on preserving their own forces rather than achieving the military aim. He pointed out that confrontational industrial war had been rendered obsolete by nuclear weaponry. Since 1945, from Korea to Malaya, from the Arab-Israeli Wars to Vietnam, warfare was 'wars fought amongst the people.'<sup>6</sup> In traditional industrial wars, there were clear divisions on which side everybody belonged to and whether they were in uniform or not.<sup>7</sup> In the 'wars fought amongst the people', the people are part of the terrain of the battlefield. The adversaries, more often than not, are non-state agents.

As the Cold War ended, the public's tolerance for military risk has dramatically shifted with expectations set by the relatively costless victory in the Gulf, the rapid withdrawal of troops from Somalia after the Battle for Mogadishu disaster and the unwillingness to send troops into conflict for fear of casualties. These fuelled the narrative for investing in unmanned systems. On 8<sup>th</sup> February, 2000, the United States (US) Senate Armed Services Committee (SASC) declared that one third of all aircraft operating behind enemy lines were to be unmanned by 2010 and one third of ground combat vehicles were to be driverless by 2015.<sup>8</sup>

Robotic systems are widely present in the modern battlefield by providing intelligence gathering, surveillance, reconnaissance, and target acquisition, designation and engagement capabilities.<sup>9</sup> In 2001, the US military had around 50 unmanned air systems. By 2013, it was operating 8,000 unmanned air systems and 12,000 unmanned ground systems.<sup>10</sup> Sir Rupert Smith also highlighted that Iraqi insurgents too had already learnt how to defeat robots used by the Explosive Ordnance Disposal (EOD) teams to make defusing Improvised Explosive Devices (IED) more difficult.<sup>11</sup> In 2007, attacks on robots were so high that a Joint Robotics Repair Facility (i.e. robot hospital) was created and saw 150 'patients' per month.<sup>12</sup>

## ROBOTIC FANTASIES FOR FUTURE WARS

Artificial Intelligence (AI) is the cornerstone of autonomous robotics capabilities. The US Navy's Office of Naval Research (ONR) has since already adopted AI to create Augmented Reality (AR) training environments for conducting exercises.<sup>13</sup> The Defense Advanced Research Projects Agency (DARPA) projected that by this decade, AI-powered robot assistants could support soldiers in the battlespace of the future. The networked

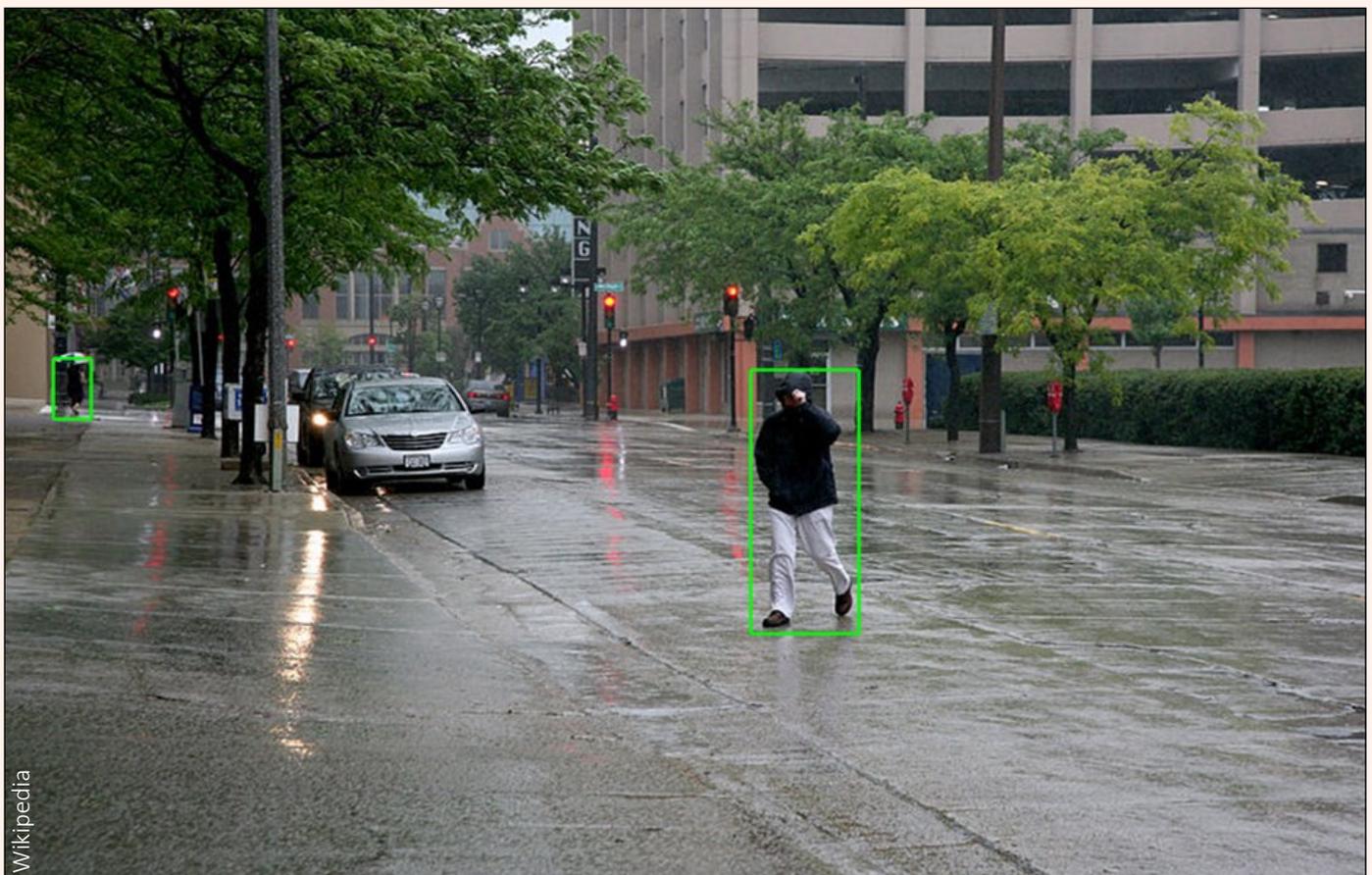
soldiers would carry Android Tactical Assault Kits (ATAK) and several wearable devices to share video, maps and other information in real-time with pilots and drones.<sup>14</sup> Recent breakthroughs in robotics, such as in self-driving vehicles, three-dimensional (3D) gaming sensors and robotic navigation found in smartphones, are enabling robots to serve practical purposes in our daily lives.<sup>15</sup> Robotics Professor Rodney Brooks projected that by 2020, robots could be exchanging knowledge of what they have learnt via cloud to enhance and accelerate their individual learning.<sup>16</sup>

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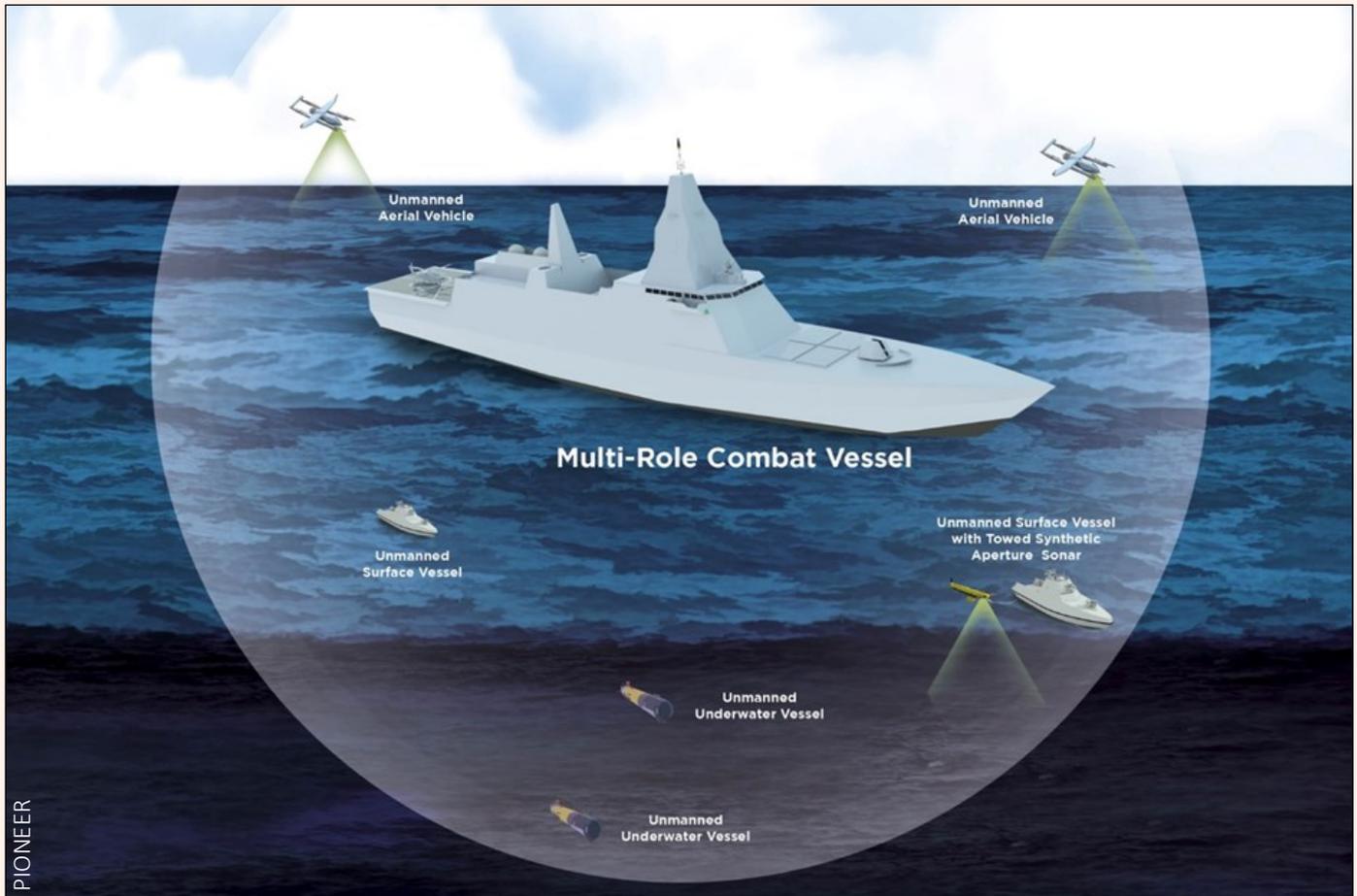
Scientists have anticipated a new battlefield unrestricted by existing technical limitations of robotics

technologies. Battle-ready machines will infiltrate and access hazardous territories, while security robots will make it less risky for the troopers operating in conflict zones.<sup>17</sup> The advances in technology will also bring about new strategic innovation to the battlefields. For instance, robotics platforms can be pre-positioned and remain in sleep-mode till triggered. Boeing is already one step close to realising this with its *Echo Voyager*, an autonomous submarine that has an on-board generator that charges its own batteries when needed, allowing it to stay in the ocean for up to six continuous months.<sup>18</sup> At sea, it relays required environmental and system health information back to the control station via satellites. From a military point of view, *Echo Voyager* can perform underwater missions such as payload deployment, infrastructure protection, or subsea search and reconnaissance. Robots like *Echo Voyager* will afford higher consistency of performance since they are not influenced by morale, family support, loyalty or spiritual belief. For land warfare, there are also concept plans to convert supply trucks and Humvees to unmanned vehicles.

Should space become the new battlefield of future wars, its unique nature will demand unmanned



A self-driving car system using AI to determine which parts of the picture seem to match the pedestrian.



The new Multi-Role Combat Vessel (MRCV) by the Republic of Singapore Navy is designed for leaner manning and incorporates automation technologies. These improvements will save operational costs by up to 10 per cent compared to similar-sized frigates.

robots to play an exclusive role, since getting humans into space itself is a huge risk and engineering endeavour. Already space weapons such as the X-41 Common Aero Vehicle are being developed and planned for testing. The X-41 is a cross between an intercontinental ballistic missile and a transport for travelling the border between space and the atmosphere.<sup>19</sup> This gives its operator 30 minutes to drop a bomb on anyone in the world.

At sea, the concept of pushing robotic sensors and weapons further away from manned platforms has changed the concept of sea power. With motherships not even having to be a military platform, it has spun off a new naval concept called sea-basing where large container ships can act like floating harbours. At the same time, robot swarms, comprising robots designed in various shapes and sizes, can collaborate to meet the needs of different operations. Sir Rupert Smith pointed out that Alfred Thayer Mahan's *Influence of Sea Power on History* argued that nations became great because of their navies winning big showdown sea battles.<sup>20</sup> With

robots, the future of war at sea will look less like that with the rise of asymmetric threats and unmanned responses. Fleets are unlikely to be concentrated as Mahan anticipated. Rather, the naval fleet will be flexible by having groups of smaller and unmanned platforms to swarm the adversary. With swarm robots, it could realise Clausewitz's description of guerrilla tactics where the system would become a 'dark and menacing cloud out of which a bolt of lightning may strike at any time.'<sup>21</sup>

## CONSTRAINTS ON THE USE OF WAR ROBOTS

The proliferation of war robots has raised many concerns. The least controversial military use for unmanned robots would be for getting to theatres that are inaccessible or too dangerous for soldiers. Using robots as a weapon system has however raised much criticism, even though the line between unmanned combat air vehicles and missiles such as loitering munitions, is increasingly blurred.<sup>22</sup> The International Committee of Red Cross (ICRC) highlighted concerns of

unmanned machines having a very limited understanding of our complex and changing environments. Their algorithms require large amounts of information about the environment to ensure a robust design. Hence, it is unlikely that a single robot design can be suited for different military needs.<sup>23</sup> The United Nations (UN) General Assembly (GA) in 2013 even called for states to establish national moratoria and policy on aspects of Lethal Autonomous Robots (LAR).<sup>24</sup>

There are sufficient catastrophic unmanned system failures pointing to the limitations of current robotic technology. In 2007, during a training exercise by the South African National Defence Force (SANDF), a 35 mm anti-aircraft weapon's automatic mode malfunctioned, killing 9 soldiers and seriously injuring 14 others.<sup>25</sup> In 2007, the Sri Lanka terrorist group, the Tamil Tigers, hijacked signals from an Intelsat satellite to beam its own message back to Earth.<sup>26</sup> And in 2012, researchers demonstrated the vulnerability of remotely operated unmanned systems by using a 'fake' Ground Positioning System (GPS) communications signal to redirect an unmanned air system.<sup>27</sup>

Another aspect is the undisciplined reliance developed by the human operators on automation. In 2003, US fighter jets were mistakenly identified as incoming rockets by a US Patriot air defence system in Iraq, because functions of the weapon system were automated without full consideration of how operators could effectively monitor and override the system when necessary.<sup>28</sup> In 1998, the *USS Vincennes* was patrolling the Persian Gulf when its Aegis self-defence system identified Iran Air Flight 655 as a hostile Iranian F-14A Tomcat.<sup>29</sup> Not one of the eighteen command crew was willing to challenge the Aegis when it decided to shoot down the 'Assumed Enemy'.

## RESISTANCE AGAINST KILLER ROBOTS

Beyond technical and tactical constraints, there are also moral and ethical issues when considering weaponising robots. The United Kingdom (UK) Ministry of Defence (MoD)'s Joint Doctrine articulated concerns

that 'autonomous weapon systems have no higher purpose sense on which to make decisions, no ability to deal with ambiguity, no empathy or compassion or any capacity to imagine or take responsibility for the consequences of their actions.'<sup>30</sup> Hence, the UK MoD expressed no intention to develop weapon command and control chains that operate without human intervention.

Activists have argued that autonomous robotic weapons pose challenges of accountability and legitimacy because humans cannot remain responsible for the conduct of robotic weapons since robots are not addressees of the International Humanitarian Law (IHL). For autonomous weapons to comply with IHL, they have to meet the requirements of distinction and proportionality. There were also potential 'accountability gaps' or 'accountability confusions' which would render the machines unlawful. According to the ICRC, military commanders, manufacturers and programmers may be held accountable for unlawful 'acts' of autonomous weapon systems.<sup>31</sup> However, the lack of control and unpredictability of autonomous robots make it difficult to prove that individuals involved in the programming and deployment of the weapon are criminally liable for war crimes as they may not have the knowledge or intent. Having said so, the dangers of unmanned robotic abuse in war, such as the Predator and Reaper drones, occurred even when human operators were directly in charge.<sup>32</sup>

German Legal Scientist Michael Bothe highlighted that the assessment of whether a person has surrendered requires detecting the individual's intention to surrender.<sup>33</sup> For the autonomous robots to distinguish an active combatant from one who is *hors de combat* and to respect the IHL rules, it involves the capacity to exercise qualitative judgments which current and emerging autonomous technologies do not appear capable of achieving. Robert Boothby, a British conservative politician, even surfaced whether it was practically possible to surrender to a machine as surrendering creates responsibilities such as to treat and protect the surrendered party from the dangers of further hostilities.<sup>34</sup>



*The Protector USV is an unmanned integrated naval combat system, based on a rigid hull inflatable boat. It has a complete sensor, navigation and weapon suite and can be remotely controlled from shore or from ships at sea. The USV have been deployed for maritime surveillance and force protection duties in the Northern Arabian Gulf for peace support operations and the Gulf of Aden for counter-piracy operations.*

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Professor Robin Geiss counter-argued that since autonomous robots can operate without existential risk to themselves, as compared to humans in similar scenarios, it could afford significantly longer response delays, hold a higher legal standard of protection and

compliance to be used exclusively as a weapon of last resort.<sup>35</sup> Roboticist Ronald Craig Arkin noted that accountability on the use of unmanned weapon could be improved with recording devices to review footage of lethal uses.<sup>36</sup> Professor Macro Sassòli highlighted that ‘a robot cannot be emotive’, therefore ‘it cannot hate, fear, be hungry nor tired, has no survival instinct and does not rape.’<sup>37</sup>

Professor Darren Ansell pointed out that the complex chain of steps undertaken by a human to understand, reason and decide, based on the data presented by our environment are equally difficult to reproduce in machines.<sup>38</sup> Furthermore, robotics systems are not infallible. Even when the human is co-opted into the planning and decision process, this interaction is only possible when the communication links are working. For robots to operate free from human intervention requires major leaps in computer science and autonomous systems technology. Professor

Kenneth Anderson was optimistic that AI would eventually augment robots with complex reasoning and qualitative judgments so that they might be fair substitutes for humans under certain restrictions.<sup>39</sup>

## THE NARRATIVE FOR WAR ROBOTS

Martin Van Creveld noted that the wars of the future would not be waged by armies but by groups whom we called terrorist, guerrillas, bandits and robbers.<sup>40</sup> Sir Rupert Smith similarly pointed out that ‘the Falklands War was the only in most recent time, an old style industrial war.’<sup>41</sup> Military engagements can take place anywhere in the new battlefields—in the presence of civilians, against civilians, and in the defence of civilians. The application of force is then made more difficult because of the inability to distinguish friend from foe. Associate Professor David Grondin illustrated that slogans such as ‘Support the troops, not the war’ and ‘Bring the troops home now’ are examples of how anti-war protesters expressed to tap into the growing public sense that politicians were out of touch with the realities of war.<sup>42</sup> Grondin explained the ‘Body-Bag effect’ and how it influenced public opinion against support for a war. The UK MoD’s policy strategy has even articulated that gaining better public support for war will require a clearer narrative for the necessary sacrifice, reduced profiling of repatriation ceremonies and greater use of unmanned technology.<sup>43</sup>

**Today’s military commanders must plan to fight and defend across a multi-dimensional battlespace that includes the electromagnetic spectrum and cyberspace.**

Sir Rupert Smith pointed out that winning the war against insurgencies requires people to solve the root causes.<sup>44</sup> This is where unmanned technology is useful because drones can ‘dwell and stare’ unnoticed at a target over long periods. The lower the casualties, the greater the chances that politicians can stick with counterinsurgency efforts over a long period required

for success.<sup>45</sup> While total war is almost unimaginable, since the price of war is deemed too inhibitive for any sensible modern democracy, Dr Jai Galliot argued that the ease in deploying unmanned technology might just encourage pre-emptive strikes.<sup>46</sup>

## ‘UN-MANNING’ OF WAR

‘The introduction of robots to war will make a fundamental shift in mindsets and competencies.’<sup>47</sup> Sir Rupert Smith illustrated this with an analogy of how the invention of automobiles not only reshaped how people travel, but also sparked off changes such as suburban cities, global warming due to carbon emission, and the social phenomena of picking a date using the car. Similarly, carrying out war remotely has changed the traditional principle of unit cohesion. US Drone Commander Gary Fabricius explained that ‘camaraderie was lost because the soldiers were not producing the same sorts of bonds...a bit like Facebook friendship.’<sup>48</sup> He also cautioned that ‘just as it is convenient for anyone to sign in and ask for information and mission help, it is a danger too in that virtual hook-up environment.’

Professor Colin S. Gray highlighted that commanders in the 1900s lived in a strategic world that was simpler with only operations on land and the surface of the sea.<sup>49</sup> Today’s military commanders must plan to fight and defend across a multi-dimensional battlespace that includes the electromagnetic spectrum and cyberspace. They also have to consider weapons of mass destruction and irregular warfare as distinctive forms of conflict that might turn into a catastrophic terrorism if they exist together. Technology is but one dimension of the essential unity of strategy. In modern warfighting, we should expect to see the co-deployment of robots, manned systems and troops. Robots will be deployed more extensively in areas of risk minimisation and force-multiplication. Robots may augment humans in war but are not an adequate substitution just yet. The need for boots on the ground to exercise moral discretion and stay within the bounds of humanitarian laws has become even more critical in modern hybrid war. The decision of war is one that has to be decided by man. The machine can only do the heavy lifting and at the frontline. AI is, after all, still artificial and man-

made. With war robots, one may posit to take the humans, and not humanity, out of war.

As war is a continuum of requirements and actions for its effective prosecution, it is clear why robots will not replace humans in the foreseeable future since human conceptualised the requirements. However, the 'robotisation' of war does not imply the 'un-manning' of war. The man-in-the-loop remains critical, because war needs humans as the directing mind and conscience to keep it both rational and moral. After all, war, as Clausewitz puts it, is but an extension of policy by other means, a political instrument that directs the use of force towards a rational policy end. Historian Sir Hew Strachan and Professor Sibylle Scheipers reminded us that though Clausewitz identified war solely with the state and as an instrument of state policy, he was referring to the utility of war. The very beginning of *On War* even declared war as 'a clash of wills', hence it continues to apply to today's modern asymmetrical and hybrid warfare.<sup>50</sup>

Weapon delivery is becoming so fast and complex that it may soon exceed the human's ability to process and respond to the information they are presented with. While AI is a good human augmentation, past tragedies have highlighted the dangers should autonomous weapon systems stray or get hijacked from their normal functioning. Computer Scientist Noel Sharkey has proposed design definitions for the level of transparency and accountability in the autonomous systems so that military users can better appreciate the liberties being delegated to their robots.<sup>51</sup> Michael Barnes and William Evans highlighted that the robot and human interaction is always asymmetric since only the human is responsible for the team's result because only

he can fully understand the political context, changing tactics, meta-goals and act as a back-up when events do not happen as planned.<sup>52</sup>

American Political Scientist Peter Warren Singer provided the profound thoughts that advancing technologies will change the frontlines as well as the homefront politics. He shared that 'replacing soldiers with machines will save some lives, but will also lower the morale and psychological barriers to killing.'<sup>53</sup> The warrior ethos, which has long defined the soldier's identity, will erode. Moving humans off the battlefield makes wars easier to start, but more complex to fight. As other nations and even terrorist organisations start to acquire their own robotic weapons, the robot revolution could undermine the military's pre-eminence. Paradoxically, these new technologies will bring war closer to our doorstep.

## CONCLUSION

In conclusion, robots will enable unmanned warfare to complement areas where human capabilities are limited. But they are not ready to conduct a totally 'unmanned' war just yet. War is the continuation of policy and is a mere instrument to achieve a political case that comprises the trinity of the Government to provide the political objectives, the Military as the instrument to achieve the political means, and finally the People. One may take the war out of peace-loving humans, but it is unlikely that humans will be removed from war anytime soon. As elegantly concluded by P. W. Singer in his book, *Wired for War: The Robotics Revolution and Conflict in the 21st Century*, 'our machines may not be the only thing wired for war.'<sup>54</sup>

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