

WAR GAMES

Ace at Call Of Duty but a coward in real life? Then we've got the war for you! With more robots in the field than ever before, the Afghan conflict is rewiring combat for the Playstation generation

Words: PW Singer
Illustration: Lewis Cham

At the age of 18 years old, Joel Clark tried to join the US Army to become a helicopter mechanic. His high school report, however, revealed a problem: Joel had failed his English Literature class. But then as he tells it, "I always viewed high school as more of a social hangout than a place of education." In typical military logic, this meant he was not qualified to be a mechanic. The Army recruiter, though, not keen to lose a young man who wanted to serve his country, asked him if he instead wanted to become a '96 Uniform'. And that is how Joel Clark became a robotic drone pilot.

It had never been part of Joel's life plans to fly drones in wars. "But the idea of running a robot spy plane sounded pretty rad." Plus he had a bigger goal in mind. "The only thing that I was concerned about when I got on the plane to basic training was making my father proud. Failing to graduate on time had put a rift in our relationship, so my goal was to complete this task to the best of my ability in order to regain his confidence in me."

Joel's journey took him from basic training, a stage that all young enlisted soldiers go through, to Fort Huachuca in Arizona. A 125-year-old base ten miles from the Mexican border, Huachuca is

the home of the US Army's training school for unmanned aircraft.

Joel proved a quick study. Like most kids of Generation Y, he was a whizz at computer and video games, perhaps in part explaining his sub-par English grades. It also helped that the controls of the robotic drones Joel was learning to fly in combat were not all that dissimilar from the ones in the Xbox and PlayStation video games that he continued to play during his off time back in the barracks. After a few months of training, Joel was ready. He may not have been able to pass that horrible English class, but the US Army judged him to be qualified to fly missions in 'the big sandbox' – what the trainees called Iraq.

He recounts his time in the war. "I love my job. I have done a lot with and for UAS [unmanned air system]. The most rewarding experience I have had working with UAS would have to be the number of insurgents I have personally been responsible for capturing. Nothing feels more rewarding than watching the final takedown of an insurgent after guiding troops to a position..."

In fact, Joel proved so good at the task that upon his return from Iraq, he was posted back to Huachuca. The Army promoted him to a specialist, one rank below a sergeant, and made him an

instructor. Through this new technology, this young man had found his calling and was teaching the next classes of drone pilots.

Of course, the story of Joel's journey is not one that everyone finds equally "rad". I recently recounted it to a group at the US Air Force Academy. Instead of being pleased for him, they found it incredibly discomfiting that a teenager – with no qualifications – at the rank of a mere enlisted man, and perhaps worst of all, serving in the Army, was taking on a job that up to now had been exclusively reserved for college-educated, Air Force pilots; officers at what they considered the height of the military profession.

But then the English knights likely had a similar sort of feeling watching their own peasant longbow archers end the age of chivalry at the Battle of Crécy in 1346. As likely did cavalry officers the first time they saw a machine gun in World War I...

The killer app

In technology circles, new products that change the rules of the game, such as what Apple's iPod did to the music industry, are called 'killer apps', short for 'killer applications'. But today, a new generation of technology is giving this phrase a literal meaning. As Joel Clark puts it, "Unmanned systems are the future of warfare. It sounds cliché, but it is reality."

The US military went into Iraq in 2003 with just a handful of drones in the air and zero unmanned systems on the ground, none of them armed. Today, there are over 7,000 drones in the US inventory, such as the mini-plane-shaped Predator drone, and another 12,000 on the ground, like the bomb-disposing Packbot – a robot made by iRobot, the very same company that makes the obstacle-avoiding Roomba robotic vacuum cleaner.

These machines have followed much the same pathway as the early airplanes did. First they were science fiction, then made reality, then made lethal. AA Milne, the inventor of the loveable *Winnie the Pooh* series, was actually among the first to theorise that the "aeroplane" might be used in war. At the start of World War I, this finally came to be, but the early planes were just used for observation. Then, the first pilots decided that if they could see the bad guy, they should do something about it, and so began to arm their planes with an ad-hoc mixture of rifles, pistols and homemade bombs. Very soon, specially designed bomber planes were built, and then fighter planes to shoot them down. The era of aerial warfare had begun.

The same has played out with early robots in today's wars. The Predator, for example, was essentially just a remotely piloted flying pair of binoculars until US planners got frustrated that it kept sighting Osama Bin Laden at his training camps

back in 2001, but was not able to do anything about it. The 27-foot-long plane was then armed with Hellfire missiles and proved so useful that the commander of US forces in the Middle East described it as his "most valuable" weapon system.

On the ground, robots were similarly first used for observation, but are now being armed with everything from shotguns to machine guns. The Talon, for instance, is a ground robot the size of a lawnmower. It was first used to defuse roadside bombs. It then had its gripper 'arm' replaced with a weapons mount and the SWORDS (Special Weapons Observation Reconnaissance Detection System) was born. Akin to a Transformers

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toy made just for soldiers, SWORDS can swap in and out pretty much any weapon that weighs under 135kg, ranging from an M-16 rifle and .50 calibre machine gun to a 40mm grenade launcher or an anti-tank rocket launcher. As one report declares, "With this increased firepower, soldiers and their robots will be able to wreak absolute havoc on the battlefield."

Experiences like Joel Clark's and the introduction of machines like the SWORDS are part of something big going on in the history of war, and maybe even of humanity itself. We are living through a 'robotics revolution'.

To be clear: this is not the type of uprising where you need worry about the governor of California showing up at your door, like the Terminator. Instead, it is a revolution of technology and politics, a time in which we are starting to question not only what is possible that was impossible before, but also what is proper, on areas where we didn't have to think about what was right or wrong before. Indeed, when historians look back at this period, they may conclude that we are today at the start of the greatest revolution that warfare has seen since the introduction of atomic bombs.

It may be even bigger. The new unmanned systems don't just affect the 'how' of war-fighting, they are starting to change the 'who' of the fighting at the most fundamental level. That is, every previous revolution in war was about weapons that could shoot further, like the longbow, shoot faster, like the machine gun, or had a bigger boom, like the atomic bomb.

That is certainly happening with robots,

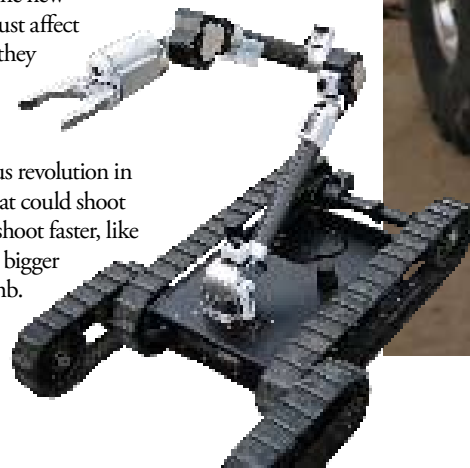
UNMANNED AND DANGEROUS

The super-advanced, hi-tech machinery currently seeing active service

[MARCbot]

It may look like a kid's truck with a mini-camera wedged to the top of its extendable arm, but this \$8,000 'diddy beast' was the first ever war robot to take an enemy's life in Iraq. US troops attached a Claymore mine to its hull and then remote navigated this robot towards the insurgents. It was the robot, not the enemy, who was seen emerging from the debris unscathed.

PackBot robots are used extensively in bomb disposal



[Fire Scout]

Seven metres long, three metres high and the unmanned jewel in the crown of the US Navy. It not only provides the military with reconnaissance reports, but can also spot enemies from up to 172 miles away while hovering 20,000 feet in the air. And when it spots the baddies? Out come its laser-targeting 'fire-and-forget' missiles.



[Global Hawk]

A modern day spy plane toting a camera with a lens that can penetrate sandstorms and thick clouds to provide a hi-res overview of the carnage a platoon may have just caused below. Impressively, it can also cover 100,000km² of terrain each day. But its downfall? Each one costs a whopping \$35 million to make.



[SWORDS]

Tipping the scales at a mere seven stone, this is able to carry a number of deployable weapons – from an M16 rifle to a six-barreled grenade launcher – its use on the Iraqi battlefield in 2007 represented the first time a US military robot had carried its own weapons into war.



[General Atomics Avenger]

Jet-propelled stealth plane that has an S-shaped exhaust to reduce the amount of heat it gives off mid-flight, thereby limiting the likelihood of it being picked up by enemy radar. It can also carry up to 3,000lbs worth of bombs, including missiles that come with a laser-tracking system for improved target precision from a height of up to 60,000 feet.

but they are also reshaping warriors' experience of war and even their very identity. In other words, humankind is starting to lose its 5,000-year-old monopoly on the fighting of war.

The ripple effects

I spent the last several years trying to capture the stories of just what is going on in this historic revolution, as robots begin to move into the fighting of our human wars. I interviewed everyone from young drone pilots like Joel to the Iraqi insurgents they are fighting thousands of miles away, from the scientists and engineers who design and build robots, to the science fiction writers who inspire them. I also wanted to get a sense of how they are being viewed, so I met with everything from the politicians who decide when and where to use them, the journalists who report their stories, and the lawyers and human rights activists trying to figure out laws of war in this strange new realm of machines at war.

The historic parallels that people make when discussing today's robotics are often astounding in their scope. One Pentagon robot designer likened where we are now to where we were with the automobile in 1908. Indeed, much like today with 'unmanned systems', back then we could only conceive of cars as 'horseless carriages', defining them more by what they are not than what they can do. Bill Gates, by contrast, made the parallel of robots being where computers were in 1980. The military was the dominant buyer of computers back then, but as new applications for computers were discovered, the market blossomed. Other scientists make a more ominous parallel to the atomic bomb. Their point is that we are now excitedly building a technology that used to only belong in the realm of science fiction (in fact, the writer HG Wells first came up with the idea of an atomic bomb in a 1914 novel). But it is of such potential power that we may one day regret inventing it. They worry they may well be repeating the experience of those in the military-codenamed Manhattan Project, who built the first atomic bomb – and then belatedly founded the nuclear arms control movement to try to ban it.

These parallels are notable because such inventions were 'revolutionary' game-changers not just because of what the technologies directly could do, but because of the ensuing ripple effects that they had on our wars and our lives beyond. The mechanisation of war from the automobile engine, for instance, not only led to the Nazis combined air-and-ground Blitzkrieg assaults during WWII, but also to the reshaping of our cities, the creation of suburbs and highways, newfound freedom for teenagers and the concept of 'dating'. And ultimately, even the warming of the planet itself.

Similarly, the atomic bomb helped keep two superpowers from going to war, but the Cold War confrontation that they did engage yielded substitute wars like Vietnam and a space race that took man to the moon. And, of course, the Pentagon's work on computers spun out everything from cyberwarfare to FHM.com.

Robots are similarly beginning to produce the same sorts of ripple effects, presenting an array of fascinating, and sometimes frightening, political, economic, legal and ethical questions. For instance, the ability to fly robotic drones from afar, as young Joel Clark did, allows valuable missions to be carried out without having to send the soldiers into harm's way. Indeed, when the very first robot was 'killed' in action in Iraq, the commander of the unit sent his condolences to the robot's manufacturer. He apologised for losing the robot, but also thanked them for the fact that he "didn't have to send a letter to its mother".

But not having to weigh such risks of war may also be making leaders more cavalier about when and where they use force. Indeed, the US has already carried out more drone strikes against suspected terrorists in Pakistan (over 50 in the last year) than it did with manned bombers during the opening round of the Kosovo War in the late '90s. But unlike that conflict, its legislature had no debates about the decision and its media barely covers the operations. Why? Because the strikes are viewed as costless.

Of course, that is only the user's perception. In Pakistan, the very same drone strikes have been hugely controversial, spurring anger and resentment, stoked all the more by reports of civilian casualties. Indeed, one of the most popular songs in Pakistan last year had lyrics describing that America looks at Pakistanis the same way it views insects; as something to be squashed from afar.

This leads to an interesting question that diplomats certainly never imagined they would have to ask: What are robots' impact on the 'war of ideas'? Some, such as one senior Bush State Department official, believe that the unmanning of war "plays to our strength. The thing that scares people is our technology". But when you speak with people in the Middle East, for instance, they describe unmanned systems quite differently. The leading newspaper editor in Lebanon told me how they are "just another sign of cold-hearted, cruel Israelis and Americans, who are also cowards because they send out machines to fight us... that they don't want to fight us like real men, but are afraid to fight. So we just have to kill a few of their soldiers to defeat them."

The point here isn't that these perceptions are always valid (indeed, the civilian casualty figures are often greatly

hyped), but rather that they take on a life of their own, with very real consequences for hearts and minds campaigns. Or, as one American military analyst claimed, the 'optics' of the situation "look really freaking bad. It makes us look like the Evil Empire from *Star Wars* and the other guys like the Rebel Alliance, defending themselves against the robot invaders."

Another example is how the idea of 'going to war' is changing not just for the nation, but for individual warriors as well. For the last 5,000 years of warfare, whether one was talking about the ancient Greeks going to war against the Persians, like the Spartans in the recent film *300*, or my grandfather going to war against the Japanese in World War II, the essence remained the same. To 'go to war' meant

'Fridge magnets which play Christmas jingles have more computing power than the entire RAF did back in 1959'

to go to a place of such danger that you might never see your family again.

That is, until today. Colonel Gary Fabricius, a US Air Force Predator drone squadron commander describes what it was like to be 'at war' against insurgents in Iraq, driving into work each day at his base in Nevada. "You are going to war for 12 hours, shooting weapons at targets, directing kills on enemy combatants and then you get in the car, drive home and within 20 minutes you are sitting at the dinner table talking to your kids about their homework."

This new aspect of being simultaneously at war, but also thousands of miles away from the war zone can lead to odd developments. For instance, when the Royal Air Force's No. 39 Squadron went to war in Afghanistan, it did so by flying its unmanned planes to Central Asia, but sending its pilots to go and sit behind computer screens in Nevada.

Open source war

But those fighting for militaries are not the only ones using these new technologies. A powerful rule holds in both technology and war: There is no such thing as a permanent first-mover advantage. Companies such as Commodore and Atari may have been the early leaders in computers and video games, but they certainly aren't dominant now. Similarly, the British Army may have been the first one to use the tank in World War I, but it was the German Army that figured out how to use it better by World War II.

Today, countries like the US and UK are leaders in the military robotics field, but there are over 40 other countries also



Operational some 7,000 miles away in Iraq, Predator drones are controlled from a base in Nevada



The MAARS robot carries a machine gun, tear gas, laser and loudspeaker

building and using military robots, ranging from China and Russia to Pakistan and Iran. But the use of unmanned systems is by no means limited merely to state powers. Just as the software industry has gone 'open source', so has warfare. That is, just as software programming is no longer limited to a few behemoth companies, but also kids in their basements, non-state actors can also build, buy and use the most sophisticated weapons systems. So far, these non-state actors who have entered the realm of unmanned war have ranged from a group of students at Swartmore College in Pennsylvania, who negotiated with private military firms to rent drones to deploy against the genocide in Darfur, to the Hezbollah militant group, which flew at least four drones against Israel during their recent conflict.

Akin to the effect on nations going to war, many worry that removing the human costs from a mission will similarly lower the barriers to terrorism. As the systems proliferate, they will be easier for groups to access and use and thus likely to be used more often. The commercial equivalent of the US military's Raven drone, for instance, can be built for just \$1,000. Unmanned systems not only give non-state groups the strike power once limited to states, but they also expand the roles that potential terrorist recruits can play. That is, one no longer has to be suicidal to carry out a mission with the lethality of a suicide bomber. One security analyst even described a robot in terrorist hands as "a suicide bomber on steroids".

The future

What is important to remember, though, is that the robots of today are just the first generation, the equivalent of the Wright Brother's Flyer, which laid the blueprint for today's aeroplanes, or the Model T Fords of the early 20th century compared to what is already in the prototype stage. The Predator drone, for instance, is already

being replaced by the far more menacing Reaper, a drone that is four times bigger and nine times more powerful. Among its improvements is a Microsoft Windows software package that has "automatic man-made object detection" and "coherent change detection". Not only can the plane come close to flying itself, but its sensors can recognise and categorise humans and human-made objects. It can even make sense of changes it is watching, such as being able to interpret and retrace footprints or even lawnmower tracks. Today, approximately 30 Reapers are in service, with many deployed to Afghanistan "standing alert somewhere in case a certain high-priority target pops his head out of his cave". They are also planned to fly constant watch over London, as part of the security for the 2012 Summer Olympics.

In turn, the jets' maker, the General Atomics company, has just turned out a new prototype called the Avenger.

'Terrorism is a worry... one security analyst described a robot in terrorist hands as a "suicide bomber on steroids"'

Powered by a jet engine, it can fly twice faster than the turboprop-powered Reaper, while carrying over 1,500kg of weapons. It is also specially designed to be stealthy, with radar absorbing materials, a swept wing, and internal bomb bay. Of note, the prototype also came equipped with a tail hook, potentially allowing it to land on aircraft carriers at sea. In short, the drone is being configured for use not merely against insurgents in the Middle East, but also a certain large Asian land power that shall remain nameless.

The same is happening on land. The SWORDS, for example, has a new cousin named after the Roman god of war, the MAARS (Modular Advanced Armed Robotic System). It is smarter, carries a more powerful machine gun, a green laser

'dazzler', tear gas, and a loudspeaker, perfect for warning insurgents in Arabic that "Resistance is futile", the phrase used by the robotic Borg in the *Star Trek* series.

Other prototypes range in size from planes with wings the lengths of a football field that can stay up in the air for weeks to tiny bots designed after insects. The roles they are starting to perform range from moving supplies to working as nurses in hospitals. But the crucial improvement for all is in their intelligence.

Over the last four decades, a rule called Moore's Law has held true. Named after the founder of the Intel microchip company, Moore's Law captures how the computing power of our microchips has effectively doubled every two years. The multiplying effect of Moore's Law, year after year, for instance, is the reason that fridge magnets which play Christmas jingles now have more computing power than the entire Royal Air Force did back in 1959.

If Moore's Law holds true, then within 25 years, this doubling effect will have robots running on computers that are a billion times more powerful than those today. To be clear, I don't mean 'billion' in the sort of amorphous way that people throw about the term, but literally multiplying the power of an iPhone or Predator drone by 1,000,000,000. What if Moore's Law doesn't hold true and the pace of advancement only goes one percent as fast as it has for the last few decades? Then our robots will be guided by computers a mere 1,000,000 times more powerful than today.

As robots become more intelligent and capable, so too will the issues that surround robotics become even more complex. The issue of war crimes proves this. Says a senior executive at Foster-

Miller, the maker of the SWORDS: "The big advantage of moving to armed robots is that you take the emotion, the fear factor out of the decision to shoot... You are looking in the whites of their eyes but you're calm." Although while the distancing allowed by technology might well lessen the likelihood of anger-fuelled war crimes, it also makes the experience of war something new, perhaps too easy to contemplate. As a young air force lieutenant described what it was like to coordinate unmanned air strikes in Iraq: "It's like a videogame, the ability to kill. It's, like, freaking cool." And, as anyone who has played *Grand Theft Auto* can attest, sometimes we do things in the virtual world that aren't so 'freaking cool' in the light of day.

12
The many thousands of remote-controlled robots currently aiding soldiers on the ground in Iraq.

515 billion

The amount in dollars the US government spends on defence each year, not including the money spent on operations in Afghanistan and Iraq.

The soldiers behind the current systems at war, though, still are in the loop of decision-making, able to decide when and at what to shoot at. But as the next generation of robots gain more and more intelligence and autonomy, their emotions of war won't just be changed, but taken completely out of the equation.

The consequences are immense and can go in all sorts of directions. A computer has no anger to make it lash out when its friends are killed. So it won't commit many of the war crimes that soldiers might. But it also has no innate sense of pity, disgust, guilt, or honour – everything that defines what it means to be a human being at war. To a robot guided by artificial intelligence, a T-80 tank and an 80-year-old grandmother in her wheelchair look effectively the same; the only difference is the order of a few zeros and ones in the software.

Yet the laws of war that must deal with this, such as the POW-protecting Geneva Conventions, are so old that if they were people, they would qualify for retirement benefits. Managing digital warfare is a lot to expect of a treaty that was written when Clement Atlee was the Prime Minister in the late '40s, the average house in America cost \$7,400 and people listened to music on 45rpm record players. Indeed, I once asked leaders at Human Rights Watch about what laws we should turn to when a machine like a Predator drone mistakenly hits the wrong target. One leader argued that the 'Prime Directive' from the *Star Trek* series would be more useful than the current laws of war. I love Captain Kirk as much as the next guy, but if that is as good as it gets, we're grasping at straws right now.

In short, machines aren't going to completely replace humans at war anytime soon in the vein of the *Terminator* films. And, even more so, war and all its facets remain driven by our human frailties and failings. But that doesn't change the reality that robots on the battlefield, and the science fiction-like dilemmas they present, are fast becoming a science fact that we had better own up to.

Of course, maybe we shouldn't trouble our pretty little monkey brains with all this. Indeed, one scientist working for the Pentagon told me that there really weren't any political, military, legal or ethical complications that he could see our growing use of robots presenting in war. That is, he added, "Unless the machine kills the wrong people, repeatedly... Then it's just a product recall issue." FHM

PW Singer has aided President Barack Obama, as well as TV show The West Wing, on matters of national defence. His latest book Wired For War: The Robotics Revolution And Conflict In The 21st Century is out now