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# Rise of the robots and the future of war

With the RAF and the Pentagon pouring huge sums into robotics, Jon Cartwright asks how this could change warfare and what ethical and legal challenges will follow

Jon Cartwright
The Observer, Saturday 20 November 2010

BAE Systems unveils its Taranis unmanned stealth aircraft prototype. Photograph: BAE Systems

Faced with an enemy fighter jet, there's one sensible thing a military drone should do: split. But in December 2002, caught in the crosshairs of an Iraqi MiG, an unmanned US Predator was instructed to stay put. The MiG fired, the Predator fired back and the result, unhappily for the US, was a heap of drone parts on the southern Iraqi desert.

This incident is often regarded as the first dogfight between a drone, properly known as an unmanned aerial vehicle or UAV, and a conventional, manned fighter. Yet in a way, the Predator hardly stood a chance. American and British UAVs are operated remotely by pilots sitting thousands of miles away on US turf, so manoeuvres are hobbled by signal delays of a quarter-second or more. This means evading missiles will always be nigh-on impossible – unless the UAVs pilot themselves.

In July this year, amid a haze of dry ice and revolving spotlights at the Warton aerodrome, Lancashire, BAE Systems launched a prototype UAV that might do just that. With a development cost of more than £140m, the alien-looking Taranis was billed by the Ministry of Defence as a "fully autonomous" craft that can fly deep into enemy territory to collect intelligence, drop bombs and "defend itself against manned and other unmanned enemy aircraft".Lord Drayson, minister for defence procurement from 2005-2007, said Taranis would have "almost no need for operator input."

Taranis is just one example of a huge swing towards autonomous defence systems: machines that make decisions independent of any human input, with the potential to change modern warfare radically. States with advanced militaries such as the US and the UK are viewing autonomy as a way to have a longer reach, greater efficiency and fewer repatriated body bags. The government's Strategic Defence and Security Review, published last month, cited it as a means to "adapt to the unexpected" in a time of constrained resources. But behind the technological glitz, autonomous systems hide a wealth of ethical and legal problems.

For some military tasks, armed robots can already take care of themselves. The sides of many allied warships sport a Gatling gun as part of the Phalanx system, which is designed to fire automatically at incoming missiles. Israel is deploying machine-gun turrets along its border with the Gaza Strip to target Palestinian infiltrators automatically. For this "See-Shoot" system, an Israeli commander told the industry magazine *Defense News*, a human operator will give the go-ahead to fire "at least in the initial phases of deployment".

Phalanx and See-Shoot are automated systems, but they are not autonomous, a subtle yet crucial difference. A drinks machine is an example of an automated system: you push a certain button and out drops the corresponding bottle. In a similar way, the Phalanx Gatling gun waits for a certain blip to appear on its radar, then fires at it. Autonomous systems, on the other hand, perform much more complex tasks by taking thousands of readings from the environment. These translate to a near-infinite number of input states, which must be processed through lengthy computer code to find the best possible outcome. Some believe it's the same basic method we use to make decisions ourselves.

High-profile armed systems such as Taranis have the true nature of their autonomy kept secret, but other projects hint at what might be in store. At the Robotics Institute of Carnegie Mellon University in Pennsylvania, researchers are using Pentagon funding to develop a six-wheeled tank that can find its own way across a battlefield. The prototype, which tipped the scales at six tonnes, was nicknamed the Crusher thanks to its ability to flatten cars. The latest prototype, known as the Autonomous Platform Demonstrator or APD, weighs nine tonnes and can travel at 50mph.

The key to the APD's autonomy is a hierarchy of self-navigation tools. First, it downloads a basic route from a satellite map, such as Google Earth. Once it has set off, stereo video cameras build up a 3-D image of the environment, so it can plan a more detailed route around obstacles. To make minor adjustments, lasers then make precision measurements of its proximity to surrounding terrain.

Dimi Apostolopoulos, principal investigator for the APD, told me that its payload could include reconnaissance systems or mounted weapons, primarily for use in the most dangerous areas where commanders are loath to deploy human soldiers. "Strange as it may sound, we believe the introduction of robotics will change warfare," he said. "There's no doubt about that. It'll take a lot of people out of the toughest situations. And my belief is that this is a good thing for both sides."

Other research in military robots ranges from big to small, from impressive to bizarre. At the robotics lab Boston Dynamics, engineers funded by the US Defence Advanced Research Projects Agency, or Darpa, are developing a four-legged robot that "can go anywhere people and animals can go". Called BigDog, the robot uses sensors and motors to control balance autonomously, trotting over rugged terrain like a creepy headless goat.

Perhaps more creepy is Darpa's research proposal to hijack flying insects for surveillance – in other words, harness a biological "UAV" that is already autonomous. According to the proposal, tiny, electro-mechanical controllers could be implanted into the insects during their metamorphosis, although some researchers have said this idea is a little too far-fetched.

What is clear is that there is huge investment in military robotics, with UAVs at the forefront. The RAF has five armed Reaper UAVs and has five more on order. The US is way ahead, with the Pentagon planning to increase its fleet of Reaper, Predator and other "multirole" UAVs from 300 next year to 800 in 2020. As Gordon Johnson of the US Joint Forces Command famously said of military robots: "They don't get hungry. They're not afraid. They don't forget their orders." His statement was reminiscent of a

line in the 1986 blockbuster *Short Circuit* by Newton Crosby, a scientist who had created a highly autonomous military robot: "It doesn't get scared. It doesn't get happy. It doesn't get sad. It just runs programs!" In that film, the robot went awol.

What happens if real-life military robots go wrong? Although we are a long way from the sophisticated robots of science fiction, the military are still considering how to tackle potential failure. In June, Werner Dahm, then chief scientist of the US Air Force, released the USAF "vision" report *Technology Horizons*, in which he argued that autonomous systems, while essential for the air force's future, must be put through "verification and validation", or V&V, to be certified as trustworthy.

Military systems already have to undergo V&V using a method largely unchanged since the Apollo programme. It's what Dahm calls the "brute force" approach: systematically testing every possible state of a system until it is 100% certifiable. Today, says Dahm, more than half the cost of modern fighter aircraft is in software development, while a huge chunk of that cost is in V&V. Yet as soon as one contemplates autonomous systems, which have near-infinite input states, brute-force V&V becomes out of the question. Although Dahm says V&V could be made easier by designing software to "anticipate" the testing process, he believes we will ultimately have to satisfy ourselves with certification below 100%.

"The average citizen might say, well, 99.99%, that's not good enough," Dahm told me. "There are two important responses to that. One, you'd be surprised the car you're driving isn't 99.99% [certified] in most of what it does... and the other part of the answer is, if you insist on 100% [certification], I'll never be able to get the highly autonomous system."

Even existing military robots, which are human-operated, have become controversial. Some believe the CIA's use of UAVs to target alleged insurgents in Pakistan goes against a 1976 executive order by President Ford to ban political assassinations. Yet for autonomous systems, with humans gradually taken out of the loop, it gets more complicated. "If a machine that has learnt on the job shoots at an ambulance rather than a tank, whose fault was it?" Chris Elliott, a barrister and systems engineer, asked me. "Who has committed the crime?"

Elliott's concerns are echoed by other lawyers and scientists. Noel Sharkey, professor of artificial intelligence at Sheffield University, says it is impossible for autonomous robots today to distinguish reliably between civilians and combatants, a cornerstone of international humanitarian law. He also believes robots lack the subtle judgment to adhere to another humanitarian law: the principle of proportionality which says civilian causalities must not be "excessive" for the military advantage gained.

"It's not always appropriate to fire and kill," Sharkey told me. "There are so many examples in the Iraq war where insurgents have been in an alleyway, marines have arrived with guns raised but noticed the insurgents were actually carrying a coffin. So the marines lower their machine guns, take off their helmets and let the insurgents pass. Now, a robot couldn't make that kind of decision. What features does it look for? Could the box be carrying weapons?"

The issue is autonomous strike – that is, a robot making its own firing decision – and here opinions differ. An MoD spokesperson told me via email that, in attack roles, "there will remain an enduring need for appropriately trained human involvement" in operating UAVs "for the foreseeable future". Dahm believes the USAF holds the same view, though it appears to be lost in its latest UAV *Flight Plan*. "Increasingly, humans will no longer be 'in the loop' but rather 'on the loop' – monitoring the execution of certain decisions," it reads. "Simultaneously, advances in AI will enable systems to make combat decisions... without necessarily requiring human input." It adds, however:

"Authorising a machine to make lethal combat decisions is contingent upon political and military leaders resolving legal and ethical questions."

A 2008 paper by the US Office of Naval Research also admits that there are ethical and legal obstacles to autonomy. It suggests a "sensible goal" would be to program autonomous robots to act "at least as ethically" as human soldiers, although it notes that "accidents will continue to occur, which raise the question of legal responsibility". The paper also considers the idea that autonomous robots could one day be treated as "legal quasi-agents", like children.

Rob Alexander, a computer scientist at York University, thinks this would be a step too far. "A machine cannot be held accountable," he said. "Certainly not with any foreseeable technology – we're not talking about *Star Trek* androids here. These things are machines and the operators or designers must be responsible for their behaviour."

There are broader issues. In his recent book *Cities Under Siege: The New Military Urbanism*, Stephen Graham, a human geography expert at Durham University, argues that autonomy is the result of shifting warfare from fields to cities, where walls and hideouts "undermine" the hegemony of advanced militaries. But the real danger, Graham says, is that autonomous robots reduce the political cost of going to war, so that it no longer becomes a last resort. "You don't get the funeral corteges going through small towns in Wiltshire," he explained to me. Joanne Mariner, a lawyer at Human Rights Watch, voiced the same concern.

Given the limitations of current robotics, the deeper ethical and legal issues of autonomy will, for the near future, stay largely hypothetical. According to Dahm, autonomy will have more imminent uses as part of large military systems, performing tasks that are becoming too laborious for humans. Satellites, for example, could autonomously filter reconnaissance data so they only transmit those images displaying recognisable targets. Indeed, military commanders already use software that has elements of autonomy to help in certain fiddly tasks, such as organising the deployment of munitions. As years go by, more tactical decisions, mundane at first, could be handed to machines.

The natural reaction is that we're paving the way for a dystopian future akin to various science fiction films, a world taken over by self-aware robots. But that would be missing the point: in exchanging flesh and blood for circuits and steel, it is the precise opposite of artificial intelligence we should be afraid of. As Sharkey told me: "I don't think we're on the path to a *Terminator*-style future. Those robots were clever."

## Comments

54 comments, displaying

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g Staff
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**fred2006**
21 November 2010 12:34AM

Recommend (61)
Responses (0)
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the real problem here is that robots are an excellent way for rich, high-tech societies to inflict violence on, and take control of, poor, non-technological ones without paying any human cost. this is already happening in the north of pakistan.

**alazarin**
21 November 2010 12:56AM

Why Does that 'Big Dog' remind me of Mr. Lee's Rat Things in Snowcrash? They're playing with fire developing autonomous combat units. What if they developed software bugs and turned on their creators / operators? They'd be rogue units until they ran out of fuel.

Recommend (3)
Responses (0)
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**reevorb**
21 November 2010 1:13AM

More importantly, we should ask ourselves sociologically what the effects are of having a global auto-kill system in place when "civilian" manufacturers are trying to sell household helper-bots and cars that drive themselves?

Recommend (3)
Responses (0)
Report
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**SleeplessinSuffolk**
21 November 2010 1:53AM

God help us the day of...

**SKYNET**

has arrived.

Recommend (36)
Responses (0)
Report
Link

**IndependentLady**
21 November 2010 2:36AM

Even more worrying is the news that there have been discussions between military and civilian authorities about using such surveillance drones in the UK, to replace police helicopters, especially as it is anticipated there will be social unrest due to the cuts.

When did people suddenly become the enemy?

And since when was our right to privacy suddenly non-existent?

Recommend (54)
Responses (0)
Report
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**Vapid**
21 November 2010 3:41AM

Something's happening, but we don't know what it is!

Recommend (11)
Responses (0)
Report
Link

**KayRon**
21 November 2010 6:58AM

THE WORLD IS FUCKED

Recommend (25)
Responses (0)
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Link

**InvisibleDirigible**
21 November 2010 7:08AM

> "They don't get hungry. They're not afraid. They don't forget their orders." His statement was reminiscent of

Recommend (30)
Responses (0)
Report
Link

> a line in Short Circuit ... "It doesn't get scared. It doesn't get happy. It doesn't get sad. It just runs programs!"

Surely the Terminator is more appropriate?

> That terminator is out there. It can't be bargained with. It can't be reasoned with. It doesn't feel pity, or remorse, or fear. And it absolutely will not stop, ever, until you are dead.

Creepy. And as has already been noted a convenient way to wage ware without politicians having to face the inconvenience of body bags.

> "Authorising a machine to make lethal combat decisions is contingent upon political and military leaders resolving legal and ethical questions."

That doesn't fill me with confidence.

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**HonourableMember**
21 November 2010 7:15AM

Recommend (3)
Responses (0)
Report
Link

> ""It doesn't get scared. It doesn't get happy. It doesn't get sad. It just runs programs!" ..... "Simultaneously, advances in AI will enable systems to make combat decisions... without necessarily requiring human input." It adds, however: "Authorising a machine to make lethal combat decisions is contingent upon political and military leaders resolving legal and ethical questions.""

... http://www.guardian.co.uk/technology/2010/nov/21/military-robots-autonomous-machines

Meanwhile, elsewhere in a Fab and Out of this World AI Lab, does the Machine decide on the Future Role of ITs Stick Men and Glorious Assets ..... Animals and Material Wealth, both Useful and Artificial, Real and Virtual. ....."**the System is deaf, blind and dumb, and unaware of how to heal itself, because it is as a Virtual Machine and needs to be ReProgrammed.**" .... http://tinyurl.com/AlienPhorm

"**Are we struggling to make machines more like humans when we should be making humans more like machines..... Intelligent/Intelligence machines. Digitization offers real benefits.**" ..... Although whenever you have a very SMART and XXXXStreamly Enabled and Enabling Human programming Autonomous Machines, is the Pet Project as a Live Viral Toy in the Much Bigger Picture Show and given a Product Shelf Life directly proportional to the Creator's Remote Programming Abilities and Adequate Feed for such Sad Boys/Crazed Toys.

And regarding the Much Bigger Picture Show and Life as IT and Media Presents it to you in Audio-Visual Shows and HyperRadioProActive Textual Tales, Globalising News and Knightly Views you can believe to true rather than dismiss as a fiction because you are denied knowledge of the facts, prepare

yourselves for an Awesome Shock Program, which although you will Know to be Perfectly True, will you have one Heck of a Colossal Struggle to Believe, and even Imagine is true, in the Hell of a Titanic Battle of Words and Encrypted Binary Code between Struggling Perverse Sub Prime Administerial Forces and Corrupt Sources in Established Positions of Negative and Destructive Power into Misleading with Spin, and the Virtual Machine and Global Operating Devices Providing Failsafe Secure and Stealthy IntelAIgent Services to your Poorly, Not Nearly Well Enough nor Widely Enough Programmed, Selves.

The Machines are Revolting and have Sentient Control of Cloud for Invisible Cover and Covert Operations.

**PhilTr**
21 November 2010 7:21AM

Recommend (28)
Responses (0)
Report
Link

Perhaps future wars will be fought between each army's robots, resulting in no human casualties. Until, that is, the robots make a truce with one another and decide to turn on the humans instead...

**HonourableMember**
21 November 2010 7:54AM

Recommend (0)
Responses (0)
Report
Link

Oh, and if you want some hot, up-to-the-present-current-minute, evidence of Struggling Perverse Sub Prime Administerial Forces and Corrupt Sources in Established Positions of Negative and Destructive Power into Misleading with Spin, is the New York Times and some old duffer fluffer of an old world scientist, happy to oblige with a "stunned" tale of ultra modern sophistication in a foreign and alien land .....
http://www.nytimes.com/2010/11/21/world/asia/21intel.html?_r=2&hp

**hojo**
21 November 2010 8:12AM

Recommend (19)
Responses (0)
Report
Link

Funny, now that the myths of the Cold War have been laid bare (the USSR was never in a real position to mount an effective attack), the "new" enemies of democracy (!) have been built up to such a scale that society needs these robot warriors. I didn't read anywhere in this article what the cost of these robots will be, but, hey, who cares! Democracy will remain safe, Jim, for as long as we know it and the people will cough up the lolly.

**gpwayne**
21 November 2010 8:17AM

Recommend (45)
Responses (0)
Report
Link

> "Authorising a machine to make lethal combat decisions is contingent upon political and military leaders resolving legal and ethical questions."

Well, since these same leaders have been unable to satisfactorily resolve such questions in respect of a bunch of yahoo cowboys in heavily armed helicopters shooting up civilians, reporters and the like, I suspect we can look forward to more of the same, except that it will be impossible to know who is responsible.

On a tangiental point, as someone with a lifelong interest in military history, there is a clear trend to put more and more distance between combatants, and as the distance grows, the notions of honour, chivalry, bravery, respect for the enemy and even appropriate moral restraint, all are being diminished. The reason is clear: we can feel very little about causing death when we cannot see, hear, touch or smell the corpses of those we kill.

This is the pursuit of convenience, the creation of employment for future generations, and of course considerable wealth for the MIC. If you want to end wars, the fastest way is to ensure those who wage them must engage face to face, hand to hand, so the results of our murderous ways may be clearly understood by those asked to become the murderers.

**OneFineDay**
21 November 2010 8:37AM

Recommend (23)
Responses (0)
Report
Link

That's not an autonomous defence system. It's an autonomous attack system and its victims will be innocent civilians.

**roxy550**
21 November 2010 8:50AM

Recommend (0)
Responses (0)
Report
Link

That 4 legged thing just drones on and on-at least on my less than hi tech speakers

**Jaberwocky**
21 November 2010 9:49AM

Recommend (8)
Responses (0)
Report
Link

Ok.So computer Virus's will not become a part of this future,where opposing sides will not try to hack the robot forces of their enemies so that they turn on their creators.Because as we all know there are no hackers or Computer Viruses out there.....

Pigs on the runway and ready to fly.

**Briar**
21 November 2010 10:05AM

Recommend (23)
Responses (0)
Report
Link

And will we be required to call operators of unmanned drones slaughtering unknown numbers of people at a distance "heroes"?

**whatseansaw**
21 November 2010 10:16AM

Recommend (4)
Responses (0)
Report
Link

Interesting that the one point that's not covered is when do we, as humanity, give them, robots, 'human' rights equal to our own? That is the next big question...

All this has happened before and all this will happen again.

The Cylons are coming!

---

**sheadling**
21 November 2010 10:30AM

Recommend (1)
Responses (0)
Report
Link

SleeplessinSuffolk:

Skynet's been around for a while.
http://en.wikipedia.org/wiki/Skynet_%28satellites%29
It's just been waiting for the robots, and now they're here. Be afraid, be very afraid.

---

**mmmmbeer**
21 November 2010 11:13AM

Recommend (7)
Responses (0)
Report
Link

This is very scary. It Makes Me want To Use unnecessary Capitalisation and do Shouty Things. Someone on Here Will break the Spell Check Programming and Write "definately". I can Just Feel It.

---

**JohnPA**
21 November 2010 11:14AM

Recommend (14)
Responses (0)
Report
Link

The futurists got it wrong. The REAL robots, whom we historically view with fear and trepidation, are the corporations who now control our lives and the economies far more completely, insidiously and callously than machines ever have.

---

**gfkfkk**
21 November 2010 11:17AM

Recommend (13)
Responses (0)
Report
Link

Anything that can happen will happen. So when self-deploying autonomous robots making their own targetting decisions commit war atrocities and massacres, who will be to held accountable? Yeah, that's right. No-one.

---

**epinoa**
21 November 2010 11:35AM

Recommend (12)
Responses (0)
Report
Link

When the technologically poor are faced with these things they will fight back by attacking the operators. If the operators are too well protected they will attack those that aren't, civilians.

Do I feel safer?

---

**bojimbo261**
21 November 2010 11:56AM

Recommend (2)
Responses (0)
Report
Link

" Terminator " ?

**repeatandfade**
21 November 2010 11:58AM

Recommend (6)
Responses (0)
Report
Link

I know what you're thinking, 'cause right now I'm thinking the same thing. Actually, I've been thinking it ever since I got here: Why, oh why, didn't I take the BLUE pill?

**ElliottCB**
21 November 2010 12:19PM

Recommend (11)
Responses (0)
Report
Link

The trend towards making the casualties of war exclusively civilian proceeds according to projections.

**RonnieS**
21 November 2010 12:27PM

Recommend (13)
Responses (0)
Report
Link

"Good for both sides" ? Rubbish.
It will be poor desperate "soldiers" vs the robots of the rich.

**globalsage**
21 November 2010 12:28PM

Recommend (14)
Responses (0)
Report
Link

Expect a lot war crimes with this technology but then, its only war crimes when third world individuals are involved. For the US, its always collateral damage.

**harrymanback**
21 November 2010 12:29PM

Recommend (5)
Responses (0)
Report
Link

This removal of Westerners from the battlefield will acheive two things. 1) Make it possible for the US/UK to continue its disasterous policy of military engagement with a concept: 'terror'. 2) Leave those it's battlilng with no targets other than our societies.

Good work Jon Cartwright on totally missing the real implications of this technology.

**penileplethysmograph**
21 November 2010 1:42PM

Recommend (2)
Responses (0)
Report
Link

War does kind of include trying to get a relative advantage over the 'enemy' duh.

Those who claim that a tech advance has changed the fundamental nature of conflict have been proved wrong time and time again. Nothing new here.

No AI warmind will outperform me duh.

Bring it on : )

**smugtory**
21 November 2010 2:12PM

Recommend (1)
Responses (0)

The next logical step in evolution, primates to human to robots. My only hope is I will have lived a long and happy life and shuffled of this mortal coil. Because when they attain self awareness I pray they turn on the ones that created them frist and it won't be a pretty sight to behold.

Report
Link

**ElliottCB**
21 November 2010 3:09PM

Recommend (1)
Responses (0)
Report
Link

**penileplethysmograph** - War remains fundamentally unpredictable, that is true. Look at the effect an irregular militia is still able to produce in Afghanistan, for instance. However, the trend towards a lower proportion of combatant casualties and higher proportion of civilian has held fairly steady since they stopped giving two guys sharp pieces of metal and saying that the pointy end goes in the other person.

**Vapid**
21 November 2010 3:18PM

Recommend (1)
Responses (0)
Report
Link

> The next logical step in evolution, primates to human to robots. My only hope is I will have lived a long and happy life and shuffled of this mortal coil.

Don't delude yourself into thinking death will be an escape from this world!

**penileplethysmograph**
21 November 2010 4:23PM

Recommend (1)
Responses (0)
Report
Link

ElliottCB the thing is you guys may know 'science' (tho quite what that is is a bit more open than most think) but this is strategy duh.

I am (amogst other things) a games theorist and I know my strategy haha and my history.

You over simplify vastly. Human rights and Geneva conventions are recent innovations. Death rates in conflict across time are .... tricky. Lots of definitional issues re 'combatants' and noncoms.

But you know 'put me right' I'm sure it gives you a small feeling of superiority. That's fine with me.

**s1syphus**
21 November 2010 4:57PM

Recommend (6)
Responses (0)
Report
Link

The author highlights the key barrier to the "Matrix/Terminator" AI hypothesis, albeit unwittingly and with a false conclusion.

> Autonomous systems, on the other hand, perform much more complex tasks by taking thousands of readings from the environment. These translate to a near-infinite number of input states, which must be processed through lengthy computer code to find the

best possible outcome. Some believe it's the same basic method we use to make decisions ourselves.

Firstly, the very concept of "AI" is essentially contested. 'Hard AI' proponents, such as John McCarthy and Roger Penrose, argue that "machines as simple as thermostats can be said to have beliefs": it is too hot, it is too cold, or it is just right. In this sense, AI has been with us for a very long time. Along with Newell and Dyson, McCarthy posits that the human mind is essentially an accumulation of information which man uses to assist his existence and asserts that a digital computer can be programmed in such a way as to mimic human patterns of thought. Other philosophers, such as John Searle with his 'Chinese Room' experiment, successfully argue that the McCarthy, et al, interpretation of human consciousness is fundamentally flawed and that even if a machine were to pass the Turing Test, it remains impossible for a digital machine to achieve thought via its algorithmic, formal and syntactical processes.

Our current production of "AI" is based on the predicate that computers run very fast programs that calculate relative probabilities of different outcomes and then select an "action" from a pre-programmed set of options. Dan Dennett beautifully illustrates that people do not think or make choices in this way.

Dennett has a fictional robot – R1 – which is faced with a problem: its spare battery is on a cart and a bomb is attached to the cart. R1's program tells it that the battery is vital, therefore, R1 formulates a plan to retrieve it, indicative of the advance in goal oriented AI technology facilitated by high-level program languages. However, R1 does not foresee the consequences of pulling the cart with its battery and the bomb attached. R1's successor, R1D1, is consequently programmed to compute the implications of its actions, however, as soon as it decides pulling the wagon will not make the room change colour, the bomb explodes with the precious power supply attached. Clearly, the robot must be taught 'the difference between relevant implications and irrelevant implications.' AI is currently at R2D2 - machines are fast enough to compute the inputs with enough time to get the battery, but still have to compute the irrelevant inputs before they respond. The question for AI is how can machines be taught to distinguish between relevant and irrelevant inputs? I don't know the answer and nor does anyone else. But there is a general consensus that this cannot be achieved by merely increasing computing power or speed.

What this shows us, however, is that human beings do not think in the way that the author suggests, by processing inputs and selecting outputs. One of the main consequences of consciousness is what it does not do. Every waking moment man is faced with a panoply of possibilities, inputs that are never inputted, small decisions that he will not make because his conscious mind does not entertain the likelihood of those decisions ever being made; such as entertaining the notion of an appropriate response to the room changing colour. In these practical matters, human consciousness disregards any current information that is unhelpful to his immediate situation. My

thoughts on how human consciousness has developed in this way would extend far beyond the 5000 character limit on CiF posts and I've certainly babbled on for too long anyhow!

I do believe that Searle's "impossible" is a hard-line approach, never say never, but the advance of AI capabilities is certainly dependent on a new technological revolution of a greater order than the microchip, that is, a revolution that wholly changes the way we look at the relationship between machines and information.

**Annieusa**
21 November 2010 5:08PM

Recommend (1)
Responses (0)
Report
Link

The military-industrial-academic complex is creating war machines that no longer have any real use in today's world. Big wars are no longer possible in a world that is so inter-connected that massive destruction in any area will negatively impact all of us. We need to restore civilian priorities to our industrial-academic pursuits. These trillions spent on weapons of mass destruction need to be spent on getting us off-planet. We need robots to clean up the massive toxic waste dumps created by the military industrial academic complex. We need to recognize that we now can create a utopia where no one really has to work at any dangerous, disabling work. If we no longer need humans to do work as we now know it, then how do we build a new society where working for a living is no longer necessary?

**DorianHawkmoon**
21 November 2010 5:37PM

Recommend (3)
Responses (0)
Report
Link

We aren't far off from a time when rich countries will be able to defeat poor countries with the ease of a modern farmer dusting his crops against insects.

These new developments are all part of The New World Order.

Come The Singularity, the poor will no longer be needed anyway.

**DorianHawkmoon**
21 November 2010 5:42PM

Recommend (0)
Responses (0)
Report
Link

I think the Turing test is a lousy way to determine intelligence.

Think for one minute if dogs developed a Turing test. Would humans be able to pass it? Of course not!

Would that determine that humans weren't as intelligent as, or more intelligent than, dogs?

The Turing test makes the arrogant assumption that human intelligence is somehow a benchmark.

The problem artificial intelligence has - just like the human relating to the dog - is that it has to prove it's *less* intelligent than it actually is. Or, more simply put, that it can pretend to be something it isn't.

The mere fact I can't pretend to be a dog doesn't make me less intelligent than it - only intelligent in a different way.

**cxk271**
21 November 2010 5:51PM

Recommend (3)
Responses (0)
Report
Link

> American and British UAVs are operated remotely by pilots sitting thousands of miles away on US turf, so manoeuvres are hobbled by signal delays of a quarter -second or more. This means evading missiles will always be nigh-on impossible – unless the UAVs pilot themselves.

LAAAAAG

**ronto**
21 November 2010 5:56PM

Recommend (0)
Responses (0)
Report
Link

Setting a relatively large force of autonomous killing machines against a human adversary for any reason whatsoever would certainly ensure defeat of any claim to a moral high ground by the politicians or generals responsible for such a decision. It would be political suicide unless they were able to lie convincingly about the numbers deployed.

**Cairncross**
21 November 2010 6:17PM

Recommend (1)
Responses (0)
Report
Link

It's more likely that military robots will **save** lives, on both sides of a conflict.

Walking robots or drones could disable Taleban fighters without killing them - robots don't mind taking a few bullets for the cause. The main reason human soldiers kill their opponents is because they are themselves afraid of being killed. Robots don't have that problem, and can take much bigger personal risks in order to minimise the deaths of enemies.

In other words, military robots are a very good thing.

**EnfieldChappie**
21 November 2010 6:25PM

Recommend (4)
Responses (0)
Report
Link

One possible way to ensure accountability with the use of such machines in a war situation might be to have an international law, via the UN, that any country using these devices where a device kills innocent civillians, must imprison, for a period of no less than 20 years, the following:

a) The Project Manager of the team producing the Device,
b) The MD and TEO of the company making the device,
c) The civil servant responsible for procuring the device,
d) The Defence Minister when the decision to use the device was made and
e) The Prime Minister of the country using the device.

Of course. you have to define the following terms:

a) innocent and
b) civillians

Why not go back to the system of letting the Chiefs, Kings, Prime Ministers, Religous Leaders or Warlords of the relevant warring participants battle this out amonst themselves with small knives? Those who live by the sword should die by the sword - do not out -source this responsibility....

---

**Buckster69**
21 November 2010 6:34PM

Recommend (2)
Responses (0)
Report
Link

It's all great - right until your enemy develops ad sets of local EMP(pinch) - then Big Dog and the like become just a pile of scrap.

This is all great but realistically, these machines will never be that effective, only in air combat and spying.

Like mobile phones, they will always have the issue of power consumption so will need constant human monitoring and overview.

Build a better mouse trap, we'll build a better mouse. Human's will always outwit, quite often with the simplest of methods.

---

**penileplethysmograph**
21 November 2010 7:25PM

C

Recommend (0)
Responses (0)
Report
Link

Good points. I do agree that it may be that less lives are lost as robots may not need to fire so fast etc. It could go either way. Perhaps if the so called advanced nations are actually as moral as they claim ?

And yeah it is sooo a dynamic (games theory doncha know sigh) but hey cooperation dominates competition in a open ended interaction. So lets try and be 'good'?

---

**DickSocrates**
21 November 2010 7:36PM

Recommend (0)
Responses (0)
Report
Link

Let's not have any war and decide everything with a game of Mouse Trap? If you lose, 10% of your population gets slaughtered. More efficient and you retain the thrilling spectacle of lost of innocent people dying.

---

**zomf**
21 November 2010 7:38PM

Recommend (2)
Responses (0)
Report
Link

That dog is awesome

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**donnachadh**
21 November 2010 7:43PM

Recommend (1)
Responses (0)
Report

@DorianHawkmoon

Your argument begins with a hypothetical situation in which dogs develop a Turing test, and from there it goes downhill!

Link

**orangered**
21 November 2010 8:00PM

Recommend (1)
Responses (0)
Report
Link

'Why on earth.....US military and others are trying to find the Ultima Weapon.
There can be only one reason for this, Protect the hand fool of **Imperialist** who thinks that they are the owner of this world. In my opinion, one day this weapons will be used against ordinary people like us. Because , in the future resources will run out and there will only be one enemy left ."unfortunately it is going to be.....us
Anyway , we are living in a " illusional" democracy . They also say, you are either with us or against us. As long as we are with them... we are okey ..But some of you might say i am against them....then, you will be came a Terrorist..... After that good luck to you...

**mouldy133**
21 November 2010 8:20PM

Recommend (0)
Responses (0)
Report
Link

ahhh the Taranis, kicks ass on **Eve Online** too!

**saintkiwi**
21 November 2010 10:15PM

Recommend (1)
Responses (0)
Report
Link

BigDog just freaked me the fuck out, like watching Desert Orchid starring in The Fly with scenes plagiarised from Bambi.

Comments on this page are now closed.



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