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Robotic Warfare, Human Rights & the Rhetorics of Ethical Machines

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Abstract. Killing with robots is no more a future scenario but became a reality in the first decade of the 21st century. The U.S. and Israel forces are using uninhabited combat aerial vehicles (UCAVs) in their so-called wars on terror, especially for targeted killing missions in Iraq, Pakistan, Afghanistan as well as in Lebanon and the Palestinian occupied territories (for example in Israel's recent war on Gaza). In the last years, the number of UCAV air attacks is rising significantly as well as the number of killed civilians. Nevertheless, the automation of warfare is envisioned by the US government and military for 2032 at the latest and military robots are increasingly used in civilian contexts. In the face of these developments, discussions on robotic warfare as well as security technology from a science and technology studies and technoethical perspective are highly needed. Important questions are how robotic warfare and security applications may find their way into society on a broad scale and whether this might lead to a new global arms race, violation of the international law of warfare, an increasing endangerment of civilians transporting racist and sexist implications, and the blurring of boundaries between military, police and civil society.

Keywords. Military robot, robotics, Uninhabited Aerial Combat Vehicle (UCAV), assymetrical warfare, armchair warfare, jus in bello, racism, sexism, ethics, rhetorics of ethical killing machines, disarmament treaties

Introduction

The Iraq and Afghan wars can be seen as a test bed for the development of U.S. military robots as well as robotic warfare. While ground and water combat robots are still under development, unmanned combat aerial vehicles are already used widely. For example, today tele-operated uninhabited combat aerial vehicles (UCAVs) are regularly and in increasing numbers deployed by the US and NATO forces in the Iraq and Afghanistan wars (Cordesman, 2008). The numbers of civilians killed in these wars, probably also because of the use of these devices, are rising (Fischer 2008)[2]. At the same time, research on *autonomous* uninhabited systems that can start, land, monitor and kill people without a human in the loop are generously funded by many states including USA, Germany, France and other EU states as well as Israel (see for example Department of Defense, 2007).

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[2] See also the appendix with examples of UCAV air strikes and 'collateral damages' respectively casualities in Afghanistan, Iraq and Pakistan

These developments raise serious questions concerning international law, that is disarmament agreements, law of armed conflict, and human rights. For example, experts point out that the spread of robotic weapon systems might lead to a new global arms race as well as to the lowering of the threshold for entering into war (see Sparrow 2007, Altmann in this volume). Another issue is the blurring of boundaries between the military and the police by new and emerging technologies deployed in both contexts (for example, UCAVs for the surveillance of national borders). The bi-directional use of military / security robots opens up critical juridical, political, and social questions.

It is quite astonishing that in the face of these developments there are up to now only rarely discussions on robotic warfare as well as robot security technology. We need a close look from science and technology studies as well as (techno)ethics perspectives[3] to see whether robotic warfare and security applications may find their way into society on a broad scale – for example by causing a new global arms race, by violating international law of war by heightening the endangerment of civilians (Boës 2005, Rötzer 2007a, 2007b, Sparrow 2007), and blurring of the boundaries between military, police and civilian tasks or opening up opportunities to use killer robots for crimes (Miasnikov, 2004, 2007; Altmann, 2006).

This paper will sketch some recent UCAV developments and deployments by US, NATO, Israel and European forces and their ethical, political, and sociotechnical implications. Problems of future war scenarios are outlined with regard to human rights and international law issues. Technophilic imaginaries linked to the 'Robowar Dreams' (Graham, 2007), 'humane' warfare as well as rhetorics of a possible ethics of future autonomous robotic systems are discussed and recommendations are given.

1. Uninhabited Aerial Vehicles – Forerunner of Future Robotic Weapons

Uninhabited aerial vehicles (UAVs) have been used for surveillance since the Vietnam War, some nations are now developing and deploying combat UAVs. Especially the U.S. and Israeli[4] forces are using uninhabited combat aerial vehicles (UCAVs) for so-called 'targeted killing' missions. Most of them were executed in Iraq, Pakistan and Afghanistan respectively in the Palestinian occupied territories or in Lebanon. Especially in Iraq, Pakistan and Afghanistan, the number of UCAVs air attacks is significantly rising[5] and – despite the rhetoric of 'precision strikes' – the number of killed civilians as well. Lately, many little villages in Southern and Northern Waziristan – an area in the North of Pakistan close to the Afghan border – have been destroyed by US and NATO UCAVs, weddings have been bombarded and school and other civilian houses destroyed.

Between 2004 und 2007 the number of US air strikes rose from 285 to 1119 per year in Iraq and from 6495 auf 12.775 in Afghanistan. At the same time, the number of flying hours of uninhabited combat aerial vehicles (UCAVs) tripled between 2003 und 2007, while the number of surveillance flights in both countries rose only very slightly. Therefore it is very likely that air attacks by uninhabited combat aerial vehicles massively increased lately (see also Cordesman, 2008; Rötzer, 2008). And the numbers

[3] See for example Cerqui et al., 2006, Schomberg, 2006.
[4] Khalifa, 2008.
[5] See below.

of so-called 'collateral damages' are very high[6]. The BBC reported that in Afghanistan "civilian casualties caused by pro-government forces are rising – 577 so far this year, compared with 477 over the same period last year. Over two-thirds were caused by air strikes and the UN is calling for an independent assessment of damage, so that survivors and relatives can be compensated." (BBC News, 2008) Not all air strikes are undertaken by UCAVs but – as I said before – the numbers of UCAV strikes are rising as well as those of civilian casualties, so that a causal connection between these developments seems quite likely (Boës, 2005; Rötzer, 2007a, 2007b; Sparrow, 2007).

2. Robot Wars and UCAVs

Despite the increase of killed civilian victims by robotic warfare, armed forces and politicians are pushing the development of military robots in general and UCAVs in particular. The USA military today spends two thirds of the global expenditure for military R&D (Brzoska 2006, Altmann in this volume). It is no surprise that it is also the leading force in the development of combat robots. In 2001, the US Congress decided that the armed forces should implement "remotely controlled technology such that (1), in 2010 one-third of the aircraft in the operational deep strike force aircraft fleet are unmanned; and (2) by 2015, one-third of the operational ground combat vehicles are unmanned. (US Congress 2000, 38) An outcome of this decision was the largest technology project in history, the U.S. Future Combat Systems (FCS) – a $127-billion project – which includes uninhabited aerial and ground vehicles, inhabited vehicles, unattended sensors, new munitions, launchers, and a network for communication and data-sharing between all FCS elements (Marte, & Szabo, 2007). This program was mostly substituted by the Joint Robotics Program Master Plan in 2005. In December 2007 the 'Unmanned Systems Roadmap 2007-2032' was published by the US Department of Defence, which frames the development of robotic systems for the next 25 years. Until 2013, 21 billion dollars are planned for research, development, supply and deployment of uninhabited systems (air, water and ground) But not only the US forces are pushing the development of military robot systems. Today, more than 50 countries all over the world are working on the development of uninhabited systems (Warren 2007, Jane's 2007)

Uninhabited Air Vehicles are the most deployed military robots today. These aircraft can be operated remotely controlled and (partly) autonomously. They – and especially the future autonomous UCAVs – are predicted to be the future of military aircraft (Department of Defence 2007, Sparrow 2007). Ground combat unmanned

[6] To give one example, Anthony Lloyd of 'The Times', reported from Kandahar on May 24, 2007 about the near obliteration of the village of Gurmaw on the night of May 8, 2007: " Mr Lalai's village, a settlement in the Sarwan Qala valley north of Sangin, which is patrolled by British troops, was bombed by aircraft on the night of May 8 after fighting between the Taliban and foreign soldiers. Crawling wounded from the wreckage of his home, Mr Lalai discovered that his grandfather, grandmother, wife, father, three brothers and four sisters had died in the bombing. The youngest victim was 8, the oldest 80. Only Mr Lalai's mother and two sons, aged 5 and 3, survived. Both boys were wounded. Yet the forces that wiped out his family were not British, nor those of any other Nato unit. The airstrikes were called in by American Special Forces operating with their own rules of engagement on a mission totally devolved from Nato command in Afghanistan. At least 21 Afghan civilians died in the bombing of Gurmaw." (Loyd, 2007) In the *New York Times* Carlotta Gall reported that according to phone calls she had with local residents the toll was much higher involving 56-80 civilians.

vehicles are not yet systematically deployed and still need further research & development.

UCAVs have three components: an airplane with sensors and (partly) with weapon systems, a ground control station from which the plane is tele-operated and a communication infrastructure such as radio communication, laser or satellite link. As Altmann points out, 'flight control is done by on-board processing, but general directions and in particular attack decisions are given by remote control, often via satellite link from hundreds to many thousands of kilometres away." (Altmann in this volume) Following the dominant logic of information warfare, the video images produced by UCAVs can be transferred to ground troops, helicopters or ground vehicles. Some of the best known UCAVs which are already in production are the MQ-1 Predator and the MQ-9 Reaper of the US Air Force. In the 1990s, UAVs such as the *MQ-1 Predator* – then RQ-1 – were primarily used for surveillance. In 2001 they were retrofitted with missiles (for example, air-to-ground AGM-114 Hellfire or AIM-92-Stinger air-to-air-missiles).

Uninhabited aerial vehicles for surveillance were extensively used in NATO military operations in Kosovo and were and are regularly deployed and used also for combat by the U.S. Forces in the Afghanistan and Iraq wars (Barry/Zimet 2001; Sparrow 2007).

In May 2007, the U.S. Forces formed their first uninhabited combat aircraft wing. The 432nd Wing of the Air Force consists of six operations squadrons and a maintenance squadron of 60 MQ-1 Predator and six MQ-9 Reaper – a wing with huge bombing power up to 1.7 t. The MQ-9 Reaper is an up-graded version of the UCAV MQ-1 Predator, with 11 meters length and 20 meters wingspan. Possible payload mass is 1702 kg. The MQ-9 Reaper is capable of 14 hours non-stop flying – the F-16 is capable of 2 hours flying but at much faster speed. MQ-9's maximum speed is 400 km/h, service ceiling is 15.000 meters. Most of these UCAVs are flown from bases in the United States – about 12.000 kilometers away; only take-off and landing is operated from Afghan or Iraq bases. The tactical aim of UCAVs is to hold a huge amount of ammunition on call for short-notice strikes – especially for targeted killing missions and 'precision attacks' and thereby to combine surveillance and combat tasks. One Reaper system (a ground station and 4 planes) costs about 69 million dollars.

The 'Unmanned Systems Roadmap' of the U.S. Department of Defence states that the latest US wars have been a most welcome test bed for the weapon technologies, not only for engineers and military strategists but also for the development and fund raising: "For defense-related unmanned systems, the series of regional conflicts in which the United States has been engaged since the end of the Cold War has served to introduce and expand the capabilities of unmanned systems technology to war fighters. This conflict-driven demand has ensured the technology's evolution and continued funding, with each new conflict reinforcing the interest in such systems. Global Hawk owes its appearance over Afghanistan to the performance of Predator over Bosnia and Kosovo, which in turn owes its start to the record establishes by Pioneer in the Persian Gulf War." (Department of Defence, 2007, 47).

3. High-Tech Military Robots for Europe

The UK has ordered three MQ-9 Reapers from the USA for its Royal Air Force (Hanley, 2007). Since 2004, Predators are used by the *Italian Air Force* and since 2006

by the *Royal Air Force*. In August 2008 Germany made a request at the US Department of Defense for 5 MQ-9 Reapers (DSCA 2008). At least one Predator is also used by the *Pakistan Air Force* (Rötzer, 2007b).

The air forces of the UK, Italy, Germany and some other European countries also deploy uninhabited aerial vehicles and develop first prototypes – technology demonstrators – of uninhabited combat aerial vehicles[7]. In 2006 France, Greece, Italy, Sweden, Spain and Switzerland started to build an uninhabited combat aerial vehicle called 'Neuron' to be finalized in 2011 (Johansen, 2007). In Germany, the UCAV demonstrator Barracuda – developed in 2006 – crashed soon after its public presentation into the Mediterranean Sea because of software problems. The project was stopped thereafter. In December 2007, the European Aeronautic Defence and Space Company (EADS) announced the project Barracuda II as part of the project "Agile UAV in Network-Centric Environments" initiated by German Ministry of Defence. At the same time, EADS was awarded a 60-million contract by the German, French and Spanish governments to develop a concept for a ‚network centric warfare network'. This network is supposed to be a common platform with mobile ground stations for new modular family of German, French and Spanish UAVs that cooperate in swarms, learn and transfer their information to further systems.

4. Hermes kills in Lebanon and Palestine

The second biggest developer of UCAVs is Israel. Israel deployed UCAVs from the Hermes series (Elbit Systems Ltd.) in 2006 in the war against Lebanon, but also for surveillance, targeted killing and war operations in the West Bank and the Gaza strip. Between 2000 and 2006 three hundred people characterized as terrorists were killed – together with 129 civilians (Case 2008) Israeli Human Rights Groups filed a lawsuit against the Israeli Government. They claimed that according to Israeli as well as international law 'targeted killing' is an illegal use of force. This behaviour could be compared with those of policemen who kill the suspect instead of arresting him or her. "In December 2006, the Israeli Supreme Court issued a landmark decision in the case. While the court stopped short of an outright ban on Israel's assassinations program, it ruled that international law constrains the targeting of terror suspects. Currently, in order to justify a strike, Israel must have reliable information that the suspect is actively engaged in hostilities (such as planning a terrorist attack) and must rule out an arrest as being too risky. The court also requires that there be an independent investigation after each strike." (Case, 2008) US Human Right Groups did not go to court because they say that U.S. courts rarely dare to challenge the president's national security policy.

The killing of civilians was not an issue in this lawsuit: According to international law standards it is necessary to distinguish clearly between combatants and non-combatants, between military and civilian targets, and there has to be a proportionality of force with regard to so-called collateral damage. The intentional killing of civilians or the non-proportional injury or killing of civilians is regarded as a war crime. Regrettably, proportionality between the military aims and the injury and death of civilians in this context is defined only vaguely.

[7] The early UAVs were controlled by remote control. Full autonomy of the aerial vehicles was developed later. It is probably the case today that aerial vehicles can easily be switched from the remote control mode to one of full autonomy.

5. The Price of New Warfare Scenarios: On Racism, Sexism, & Cost-Efficiency

Given this background, military forces proceed to rely increasingly on UCAVs in their 'war on terror' in Afghanistan, Pakistan, Iraq and Gaza (Mellenthin, 2009). With nationalist rhetoric these systems are praised as the remedy to save the lives of one's own soldiers. For example, Lin et al. 2009 (in this volume) write: "Instead of our soldiers returning home in flag-draped caskets to heartbroken parents, autonomous robots […] can replace the human soldier in an increasing range of dangerous missions."

This approach relies on a problematic ontological stance. Obviously, the priority is to save the lives of one's own soldiers. There is less or no concern for the humanitarian costs of these new technologies with regard to the non-combatants of other (low-tech) nations from the South. Despite the common rhetoric of 'precision air strikes' by the military and media, the deployment of UCAVs using bombs and missiles for targeted killing costs the lives of a growing number of civilians. There seems to be an underlying racism and partially sexism that takes it as obvious that US (or NATO) soldiers are of much higher value than Afghan or Iraqi civilians – which means women, children or elderly people. Despite the fact that the attacks affect also some men and boys as well and US militaries include female soldiers, the sexism of this warfare politics lies in the *structural effects of military politics and the politics of international relations* (Tickner, 2004). Both ignore to a wide extent the different situation and needs of women and children which leads to much more severe effects of war and conflict on women (Moore, 2007) There are still astonishingly few discussions of the racist and sexist implications of the different valuation of the lives of Western troops and non-Westerns combatants as well as civilians (Butler, 2008; Herold, 2008). Sometimes, also the illusion is evoked that the coming wars will be robot wars only.

Efforts to overcome legal and techno-ethical limitations are also already under way. For example, John Canning from the Naval Surface Warfare Center proposes to use armed autonomous systems without a human-in-the loop – who is in his view always a "'performance- and cost-killer' – when considering the employment of large numbers of armed uninhabited systems" (Canning, 2007, 11). He recommends that autonomous machines should only target machines, while men target men thereby overcoming political and legal ramifications of the use of armed autonomous systems. Autonomous systems should be built with a switch between an autonomy mode and a remote-control mode. "An enemy would then have a choice of abandoning his weapon and living, or continue using it, and dying." (Canning, 2007, 31) This seems to be a quite unrealistic proposal. The impression is evoked that warfare with autonomous weapons will be mostly a robot war only – machines only fighting machines. Canning also proposes to equip autonomous weapons with video cameras in case the system is hacked by the enemy and used to kill the wrong people. That way one could give direct evidence of the guilt of hostile forces (Canning, 2007, 30). I do not think that such a high risk is tolerable with regard to civilians.

What is mostly overlooked in this context is the fact that the military also is intrigued by the cost-efficiency of military robots. UCAVs are much cheaper than jet bombers and the training of bomber pilots is much more expensive than that of U(C)AV pilots and operators of ground stations. UCAVs are also regarded as a key technology for the future market. The USA has already sold and still sells their MQ UCAVs to France, Italy and other countries. The USA spend several billions every year on drones. For example, one of the mentioned M-Q 9 Reaper systems (with four

aircraft) costs about 70 million dollars. Experts estimate that from 2015 on UCAVs sales will amount to five billion dollars every year (Nikolei, 2005). With regard to the huge techno-ethical problems Europe should engage in preventive arms control to regulate the development of this market and to prevent an arms race in the near future.

At the same time, the new warfare scenarios build on the features of new military robot technologies. For example, the UCAVs have a different tactical aim than traditional jet bombers: Predators or Reapers are supposed to function as a *permanent* threat to the enemy: "You've got a lot of ammo circling overhead on call for short-notice strikes," said John Pike, director of the military think tank, Globalsecurity. "It seems like a good idea." (Vanden Brook, 2007)

At the same time, it is much more difficult for counter-combatants from non high-tech countries to destroy UCAVs: They are only endangered by – relatively expensive – surface-to-air or air-to-air missiles. At the same time, some propose to equip UCAVs with signatures from inhabited systems to provoke an attack to discover the enemy's positions (Boës, 2005).

Especially *autonomous* UCAVs are regarded as an important part of new technoscientific warfare scenarios. Together with inhabited systems integrated in a complex network of air, water and ground agents, new techniques of warfare are developed "… toward a vision of a strategic and tactical battlespace filled with networked manned and unmanned air, ground, and maritime systems and the technologies needed for navigation and fighting. Unmanned systems provide autonomous and semi-autonomous capabilities that free warfighters from the dull, dirty, and dangerous missions that might now be better executed robotically and enable entirely new design concepts unlimited by the endurance and performance of human crews. The use of UAVs in Afghanistan and Iraq is the first step in demonstrating the transformational potential of such an approach." (Department of Defense, 2007, 34) The US forces dream of a high-tech transformation that makes them invincible. Autonomous robotic warfare systems equipped with artificial intelligence and learning capability are supposed to act – at least in the long run –more precisely, more quickly and to process more data than any system operated by a human soldier.

6. Old Dreams of Techno-Supremacy & the Production of Asymmetric Warfare

Dreams of perfect robotic and information warfare networks resonate with the older dream of power supremacy by nuclear weapons – a dream that led to a dangerous and expensive global arms race. At the same time, the dream of almighty robotic warfare seems to be undermined in the very moment of its rise. The contemporary experiences of U.S. and NATO forces in the Iraq and Afghanistan wars show – like the Vietnam War before – that high-tech supremacy does not lead automatically to supremacy in warfare. While the first Gulf war – the first one waged under the paradigm of information warfare – was a quite successful high-tech war because of its novel approach, information and cyberwar scenarios in the Afghanistan and Iraq wars did not function in the same way and led to asymmetric warfare which means here counter-insurgency warfare within cities. These asymmetric wars cost more lives (especially of US combatants) than the traditional 'Air-Land' warfare did before. And it seems to be a war that cannot be won by U.S. and NATO forces. Given these experiences, many Western military militaries do not rethink their military strategies but concentrate on high-tech solutions for 'military operations on urban terrain' (MOUT). The latter build

on the idea of installing high-tech panopticons in 'oriental' cities with their labyrinth streets and rich and complex (infra)structures. These high-tech scenarios include anticipatory tracking and risk profiling systems which use digital sensors, persistent surveillance, with "continuous, anticipatory, 'armed vision'" (Graham, 2006). Parallel to the idea of autonomous combat robots, the US military follows its dreams of autonomous electronic surveillance, tracking and targeting systems that do not only identify 'targets' but automate the destruction of the targets. This development demonstrates the endless spiral of the race for high-tech 'solutions' of war. Following this logic, low-tech insurgents will find means against panoptical, automated warfare (Boës, 2005) but it is very likely that these new ways of warfare will endanger civilians more than traditional warfare ever did. In this sense, new high-tech war is everything else anything but a 'clean', 'precision-guided' war saving the lives of one's own troops as well as those of civilians.

Starting up a new global arms race with high-tech warfare is one problematic aspect. Another one is the tremendous humanitarian consequence of urban warfare. Disarmament experts, political scientists as well as many philosophers point out that it is highly probable that automated warfare will not lead to effective deterrence and thereby to the avoidance or shortening of wars. On the contrary, automated warfare will lead to a lowering of the threshold for warfare (Altmann in this volume; Sparrow 2007)[8]. It is also unclear whether robot weapon systems are counted with regard to certain disarmament agreements such as the Conventional Forces in Europe Treaty (CFE) (Botturi et al., 2008). Altmann (in this volumes) points out that some robot systems would fall under the Treaty definitions, for others the Treaty provides mechanisms to include them The question would be whether robot systems fall under the criteria of preventive arms control such as the Conventional Forces in Europe Treaty (CFE) which sets limits to the armed forces.

7. Hacking Drones

Before I will analyze more deeply the political and ethical problems of robotic warfare and the deployment of UCAVs, I would like to point to an additional problem of robotic warfare with UCAVs: The high risks of hacking their communication structures. Until now high-volume data transfers are vulnerable to wiretap and noise. It is highly probable that hostile forces will engage in disabling the robot systems by hacking their communication infrastructure. The latter is the weak point in UCAVs (see Altmann, 2003; ISIS, 2006; Sparrow, 2007). Hacked UCAVs would be highly dangerous not only to the soldiers of one's own troops but also to anybody and especially civilians if UCAVs fall – for example –into the hands of counter-insurgents. As the military is also aware of this great danger, it is very likely that either a robot war between two high-tech nations will escalate into a space war to secure one's satellites or autonomous weapon systems (AWS) will be deployed in the near future because they are less dependent on communication systems. The latter is highly problematic with regard to the question of international law and questions of responsibility, but also with regard to the heightening speed of warfare where wrong decisions can no more be cancelled or changed (see for example Sparrow, 2009a).

[8] See also below

Another problem is that UCAVs can be reconstructed quite easily. The availability, stability and low cost of hard and software components as well as the modularity of robot systems make it possible to build surveillance drones with only little know-how – and these drones can theoretically also be equipped with bombs (ISIS Europe, 2006; Miasnikov, 2007).

8. Bi-Directional Use, Distancing & Online-War

Autonomous robot systems can be easily copied and remade. Because of the modularity and universality of today's robot systems, relevant parts can be bought from the civilian industry without any obstacles (Miasnikov, 2004, 2007; Boës, 2005, 6; ISIS, 2006). Therefore robot weapon systems can be built and used by criminals easily.

At the same time, robots developed for warfare are increasingly invading civil society. For example, UAVs are already deployed for the observation of the Californian-Mexican border by U.S. Homeland Security and the border of Switzerland[9] by the Swiss police. The German company Rheinmetall Defence has already installed an own economic sector called Homeland Security and applies for the commission to 'secure' the borders of the European Union. Up to now there are only few surveys how the bi-directional dual use of military robots might also violate rights of privacy and data protection.

Robot manufacturers like Foster-Miller, maker of the armed SWORDS robot for ground combat, are actively promoting robots equipped with tasers for U.S. police forces (Shachtman, 2007). As robots are seen as cost-savers, it is likely that robots will be increasingly used even for sensitive police tasks. Pressing social aspects and questions are often made invisible. There are already studies pointing out that the use of tasers increases the amount of violence in police-civilian encounters (LIT). It seems highly probable that this will become even more problematic with tele-operated robots equipped with tasers. Mediating interaction via technology does not always contribute to the reduction of violence.

The problematic aspects of distancing oneself from the relevant encounters have been discussed widely with regard to warfare. Weapons of mass destruction often rely on technological artefacts such as planes, missiles etc. which allow the distancing of the commanding and responsible officer. This becomes also evident with regard to UCAVs. Some remote-controlled robot combat systems – for example, the MQ-1 and MQ-9 deployed in Iraq – are controlled from Nevada, which is about 7000 km away. This might pose a real challenge for soldiers to execute their responsibility because of the hyperreal character of their actions. It becomes close to the experience of a computer game to command a robot drone for destruction which is thousands of kilometres away and to monitor the result solely via video. The question is whether a reliable experience of the consequences of one's actions can be made with regard to these remote-controlled (or even autonomous) weapon systems. Technology design should be aware of this problem and think about how to avoid these effects (Sparrow, 2009a).

[9] The EU agency Frontex is planning to use them in the near future.

9. Uninhabited Systems and Jus in Bello

Many ethicists – whether they argue from a deontological or from a consequentialist perspective – have pointed out that responsibility for the killing of human beings is a main condition for jus in bello: "If the nature of a weapon, or other means of war fighting, is such that it is *typically* impossible to identify or hold individuals responsible for the casualities that it causes then it is contrary to this important requirement of *jus in bello*." (Sparrow, 2007; emphasis given). If responsibility is no more a critical issue, this might have severe consequences for the way wars with autonomous weapon systems will be fought in the near future.

To avoid the discussion on moral problems and autonomous robots, the military often claims that autonomous systems will only be deployed under the supervision of human (military) operators (Marsiske, 2007; Sparrow, 2007). On the other hand, the U.S. military invests heavily in the development of fully autonomous systems: „DARPA is expanding the level of autonomy and robustness of robotic systems. Progress is measured in how well unmanned systems can handle increasingly complex missions in ever more complex environments […]. Autonomy and robustness are improved by networking manned and unmanned systems in a more tightly coupled combat system that will improve our knowledge of the battlespace, enhance our targeting speed and accuracy, increase survivability, and allow greater mission flexibility." (Department of Defense, 2007, p. 34)

There is an internal tension between the claim of the responsibility of military operators and the intense development of AWS: Why should one want to build fully autonomous systems and only use them as more or less remote-controlled systems? One of the main reasons for building autonomous systems is to increase the speed on the battlefield. Human operators are slowing down the velocity of the battle. On the other hand, it is very likely, that from the moment an enemy will deploy totally autonomous systems, the other side will also use them. In this case, the battle could get very easily out of control. And then there is also the 'temptation' to use fully autonomous UCAVs to avoid the communication infrastructure which might be threatened by the enemy.

There are other propositions on how to ensure responsibility with autonomous combat systems: Either responsibility is addressed towards the programmer, the machine or the commanding officer. As autonomous systems will show unpredictable behaviour, some argue that the responsibility lies by the programmer and / or manufacturer. But if the manufacturer gave appropriate information about the risks of autonomous weapons, the manufacturer cannot be held responsible for a machine failure (Nagenborg et al., 2008). Think for example of the destruction of the wrong target as an outcome of the autonomous behaviour of the system. If a system is supposed to act increasingly autonomous and the system does so, the programmer cannot be held responsible for the negative outcome of the unpredictable behaviour of an autonomous system. A programmer could be held responsible – beside those who are deploying the machines – only in a legal sense, if AWS (Autonomous Weapon Systems) would be banned internationally and he or she further participates in programming such machines.

To hold an autonomous machine responsible does not seem to be reasonable regarding their serious cognitive limitations of these systems, think for example of the state of art in object recognition, the incapability of machines to adapt the (right) rules

to complex situations adequately, etc. (see Tamburrini in this volume; Botturi et al., 2008).

The preferred approach of the military is to attribute the responsibility to the officer – as it is the case with long range weapons. This seems to be a non-satisfying and possible incorrect solution of the problem because AWS have – at least theoretically – the ability to choose their own targets: Then officers would be held responsible for weapons which they do not control. (Sparrow, 2007, p. 71)

10. Push-Button Wars on Low-Tech Nations?

As I already mentioned, one of the most pressing concerns about autonomous combat systems is that they might make going to war quite easy. Until now, in democracies a basic agreement in the population about going to war has to be achieved – or at least an disagreement has to be avoided. How will this change if war is conceived as a matter of pushing buttons from a remote place, without risk to one's own soldiers? And what chances are taken and people killed if there is no one responsible for the killing of civilians or surrendering combatants? Also disobeying inhumane orders will no more happen in robot wars. This is (or was?) a crucial part of at least a bit more humane way of warfare. We know – for example – that human soldiers often point and shoot their guns in the air and not at the combatants. But robots will always do what they are programmed for. As autonomy of weapon systems on the one hand and responsibility of the soldiers for their own deeds on the other hand is contradictory in itself, robot wars could endanger the international law of war (Geneva Conventions etc.). The general introduction of robot weapons will possibly lead to a "destabilization of the military situation between potential opponents, arms races, and proliferation, and would endanger the international law of warfare." (Altmann, 2006) And at the same time, it is quite likely that advanced and capable autonomous killing systems will be deployed anyhow because one is afraid that they might be used by one's enemy. Therefore it is highly necessary to ban autonomous weapon systems. Bans are not new. We have a ban of biological and of chemical weapons as well as of anti-personal mines in most European countries. If there could be an agreement that autonomous systems are in contradiction with the Geneva Conventions, further development, and deployment would have to be stopped. Since 2002, violations of the international laws of warfare, such as the Geneva Conventions, can also be prosecuted by the International Criminal Court in The Hague, Netherlands. In Germany, for example, there is a code of law, which enables the State Attorney? to open a lawsuit against suspects of war crimes or crimes against humanity in the cause of the international law of war.

11. The Rhetoric of Moral Machines

In the face of the serious juridical and ethical problems regarding military robots and a possible ban of military robots, research on ethics and especially so-called 'ethical' software for military robots is sponsored by the U.S. Army Research Office and the U.S. Office of Naval Research (Arkin, 2007, 2008; Moshkina, & Arkin, 2008; Lin et al. in this volume). Ronald Arkin, a roboticist at the Georgia Institute of Technology, is one of its best known figures. His approach is to embed ethics resp. software for ethical

behaviour in robots' architectures. In his paper 'Governing Lethal Behaviour: Embedding Ethics in a Hybrid/Deliberative/Reactive Robot Architecture' (2008) he even proposes that *future* robots will be more ethical than humans because they can be programmed in such a way that they do not have emotions or a drive for self-preservation. He suggests that these *future* robots might have a better sensory to destine whether a target is legitimate. He argues that robots do not have the human psychological problem of 'scenario fulfilment' which means the tendency to interpret all input according to fixed expectations and a pre-given frame of thought – a daring perspective given the fact that robots are not capable of questioning their own programming while humans have the potential to reflect on the grounding of their decisions.

According to Arkin, robots also compute information from more sources much faster, so that they have more time for reasoning about lethal decisions. He proposes that robots could even supervise the decision of the human teams they work with. (Arkin, 2007, p. 6-7) Arkin does not argue that so-called ethical robots would be perfect but that they could perform better than humans with regard to the massive violations of the laws of war during 'Operation Iraqi Freedom'. In the face of advanced weapon technology and the failure of the U.S. forces to train their troops properly with regard to ethical, intercultural and social issues, automatic ethics is invented as the only possible solution.

This reductionist and technophilic logic follows the well-known pattern of 'solving' socio-political and ethical problems via technology. But very rarely the underlying epistemological as well as ontological foundations of such a proposal are discussed. Let us see what features of his future robots Arkin takes for granted on which he builds the formalization of ethics in robots:

1. Robot systems have at least as much information as soldiers. He does not discuss the meaning of 'information' – whether this term is used in its everyday sense (linked to understanding and meaning) or in a technological sense (Shannon/Weaver) which does explicitly exclude these dimensions (Hayles 1999).
2. The proposed advanced systems do not only have the capability to resist the performance of an unethical act but to explain the reasons of their resistance. If the resistance is overridden by the commanding officer, the latter is responsible for the system's actions. This approach either suggests *highly intelligent* systems that will not become reality in the next decades (Tamburrini in this volume) or this mechanism of resistance works on a very reductionist level.
3. A central assumption of Arkin's approach to realize the formalization of ethics in robot systems is one that will not be solved in the near future: The capability of autonomous weapon systems to distinguish between soldiers, surrendering soldiers and civilians.

A central claim of Arkin's which he does not make explicit is *that every possible complex situation can be formalized correctly and computed in real time*. This is an old and never realized claim of Artificial Intelligence. But also the problems of navigation, object recognition as well as the scaling-up problem (parallel computing of many behaviours in one system) in real and complex worlds have not been solved and will not be solved in the near future in a satisfying manner.

In face of these difficulties, even Arkin's 'Closed World Assumption' does not help. The latter states that a system is never allowed to make lethal decisions in situations which are not covered by ethical prescriptions. *But the unsolvable question is: How can one make sure that a system is applying rules adequately to a certain situation and that the system decides correctly that it is allowed to apply its rule to this specific situation?*

Arkin also avoids the *problem of formal verification*. Above other things, to use autonomous lethal systems – even if they have 'ethical' software – one has to make sure that there are no bugs at all in the software. But formal verification of software for systems as complex as combat robots is not possible in a reasonable amount of time – if at all. So how can one think of 'ethical' warbots?

Analyzing this approach, one gets the impression that the development of 'ethical' software for robot systems is not driven by the intent to solve humanitarian problems in the first place but to raise acceptance for a new, emerging and highly problematic technology that ends up in highly automatized wars with unforeseeable atrocities.

Other roboticists already point out the enormous danger of the proposed autonomous weapon systems. Given the overestimation of Artifical Intelligence, the British roboticist Noel Sharkey appeals to the ethical consciousness of computer scientists and engineers to discuss the unsolved and profound technical problems of military robotic systems in public. Responsible roboticists are asked to withstand generous offers from military and civilian funding agencies as well as the perpetuation of the old and well-known salvation stories of AI. Sharkey states: "Computer professionals and engineers have a duty to ensure that the funding bodies , policy makers and – if possible – end users know the current limitations of AI technology, including potential mishaps in the complexity of unpredictable real-world events. *Do not be tempted to express your opinions or future predictions of AI as if the technology were already in place or just around the corner.* The consequences of playing the funding game are too serious. Ultimately, we must ask if we are ready to leave life-or-death-decisions to robots too dim to be called stupid." (Sharkey 2007b, p. 123; my emphasis).

12. Conclusions

Given the massive ethical and socio-political problems that come with robot weapon systems, their worldwide development and supply, as well as the increasing deployment of UCAVs, esp. for (partial illegal) targeted killing in so-called 'wars on terror', we need a broad international and public debate on robotic warfare technologies.

It is quite obvious that military robots such as UCAVs support the escalation of asymmetric warfare and lead to an increase in the numbers of killed civilians. At the same time, autonomous weapon systems are contradicting the existing law of warfare. On the one hand, they are not capable of distinguishing between soldiers, surrendering soldiers and civilians – also not in the near future; on the other hand it becomes impossible to hold soldiers responsible for their actions. As I stated above, the dominant attitude to save the lives of soldiers while endangering those of civilians in 'wars on terror' also relies on an unspoken racism and sexism – valuing the lives of U.S. or NATO soldiers higher than those of civilian Afghan, Pakistan or Iraqui women,

children and elderly people disregarding their structurally different situation and exclusion of relevant decisions in international security and warfare issues.

We need to dismantle the dream of the revolution in military affairs in terms of a perfect and clean information warfare based on the Global Information Grid (GIG) and Joint Battlespace Environment with automatic robot weapons, "- all lightness, speed, information gathering, information technology, and shared materiel" (Blackmore, 2005, p. 7). This vision suggests the elusive idea of automatic, bloodless warfare without humans. The computer-game perspective of UCAV warfare with its distancing effects produced by tele-operated drones in Afghanistan from Nevada, needs to be challenged. It seems most likely that these developments will end in wars highly risky for civilians, in a dangerous and potentially endless spiral of high-tech arms races as well as a destabilization of military balances.

Further critique of robotic warfare does not only need to focus on the contradictions to the law of warfare and the technical problems such as hacking drones or the possible reconstruction and misuse of robots by criminals, but also on the pervasion of civil society with robot applications. The surveillance of borders, but also soccer games or demonstrations with drones or the future deployment of police robots with tasers are examples of the militarization of society – treating your own people a priori as a risk factor, building on surveillance and monitoring instead of socio-political interaction and democratic processes.

At the same time, the limitations of AI resp. robot weapon systems must be repeatedly called into memory to counteract the common glorification of the capabilities of future robot weapon systems. Proposals of ethical software for killing systems must be questioned radically and the imaginary of a clean and more humane wars via robot and other high technology must be recognized as a vain dream if not cynical propaganda.

In the end, the dream of ethical killing machines is meant to silence the few remaining Western voices which are critiquing Western high-tech warfare. This dream is meant to silence those who remind us of the permanently exposed and terrified by (high-tech) war. While the dream of 'ethical' high-tech warfare supports the common western media narratives of regrettable collateral damages which will soon be avoided by more precisely functioning machines, we need to acknowledge the on-going and very effective killing of civilian Afghan, Pakistani, Palestine or Iraqi people by Western high technology.

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Appendix

Some Targeted Killing Missions by the US-Military in Afghanistan, Irak and Pakistan 2001-2008

According to the Center for Strategic & International Studies (Washington DC, USA), there was a steady rise of close air support (CAS) resp. precision strikes by jet bombers as well as U(C)AVs: In the Operation Iraqi Freedom the number of air strikes rose from 285 in 2004, to 404 in 2005. There were 229 in 2006 and 1,119 strikes by the Combined Forces in 2007. In Afghanistan the numbers rose from 86 in 2004 via 176 in 2005 to 1.770 in 2006 and 2.926 in 2007 (Cordesman, 2008). As the number of sorties for surveillance was relatively stable one can assume that more and more air strikes were carried out by UCAVs – which probably contributed to the rising number of killed civilians in the Iraq and Afghanistan wars.

T. Vanden Brook (2008) reported in *USA today*: "The use of drones, which supply 95% of the full-motion video images commanders use to watch insurgent activity, has skyrocketed in recent years. As recently as 2005, drones flew 100.000 hours, most of it in support of troops in combat in Iraq and Afghanistan. In 2008, the number of hours in flight increased to nearly 400.000." (Vanden Brook, 2008)

As information on these target killing missions is still rare in (western) media, I document some of the U.S. drone attacks I found in the literature during my investigations. This was not undertaken as a systematically survey.

Sources: Dradio.de, english.aljazeera.net, Guardian, Junge Welt, Los Angeles Times, Spiegel, Süddeutsche, Telepolis, Times of India, Washington Post, Die Welt

Afghanistan:

November 2001, senior Al Qaeda military commander Mohammed Atef was killed by a Predator strike

*February.7, 2002***:** An armed Predator attacked a convoy of sport utility vehicles, killing a suspected al Qaeda leader

March 4, 2002 a CIA-operated Predator fired a Hellfire missile into a reinforced al Qaeda machine gun bunker

February 4, 2002 a Predator fired a Hellfire missile at three men, including one nicknamed 'Tall Man' who was mistaken by CIA operators for the 6'5" feet [=1.96 m] Ossama bin Laden, near Zhawar Kili in Afghanistan's Paktia province. The victims were poor civilians gathering scrap metal from exploded missiles to sell for food.

May 6, 2002, a Predator UCAV fired a Lockheed missile at a convoy of cars in Kunar province in an attempt to assassinate Afghan warlord Gulbuddin Hekmatyar. He was not there but at least 10 civilians were killed.

August 22, 2008: "A ground force led by U.S. Special Forces (7th Special Forces Group (Airborne) based in Shindand), allegedly came under fire as it approached the village, carrying out a midnight raid to allegedly apprehend a Taliban commander, Mullah Siddiq. The U.S. Special Forces called-in close air support and a fierce bombardment of the village ensued involving both ground and air fire (including from a US Air Force Special Operations AC-130 aerial gunship, Apache attack helicopters and *Predator drones*). The U.S. bombs struck a large gathering of people who had

congregated in Azizabad to honor a local leader who had died months earlier. … The Afghan Independent Human Rights Commission (AIHRC) said its investigators on-site concluded 91 people had perished: 59 children, 19 women and 13 men. Ahmad Nader Nadery, head of the AIHRC, said 76 of the victims belonged to one large extended family – that of Timor Shah's brother who is named Reza. Reza was killed in the assault. Nadery confirmed reports from villagers that a memorial ceremony was being held for a deputy militia commander allied with the Afghan police named Timor Shah, who had died in a personal dispute several months ago." (Herold, 2008b)

Pakistan

May 13, 2005, an al Qaeda explosives expert from Yemen was killed by a CIA-operated MQ-1 Predator aircraft firing a Hellfire missile

December 3, 2005, an Al Qaeda chief and four others were killed in their sleep through a US Predator UAV

January 13, 2006 several US Predators conducted an airstrike on Damadola village in Pakistan where al Qaeda's second-in-command Ayman Zawahiri was reportedly located. Firing 10 missiles, 18 to 22 civilians were killed, including five women and five children. According to Pakistan authorities the second leader was not present, but three other leading figures were killed.

October 30, 2006, Bajaur airstrike, again the attempt to hunt down al Qaeda's second-in-command Ayman Zawahiri with predators and hellfire missiles. The strike hit a religious school. 80-86 civilians were killed. The leader was not present.

August 20, 2008: Missiles, presumably fired from an UCAV, destroyed the house of the tribal elder in Sari Nur in South Waziristan, near the border of Afghanistan. Six people were killed and three injured.

August 30, 2008: Missile attack on a house in Korsai/South Waziristan by a drone or bomber. Following local reports, four humans were killed and two injured. Two of the killed people were said to be Canadians with Arabic heritage.

September 4, 2008: Missile attack via a Predator UCAV on a house in the village of Achar Khel in Northern Waziristan. Six people were killed, said to be members of Al-Qaida

September 5, 2008: Missile attack by a drone on two houses in the village Garwek in Northern Waziristan. According to local reports, seven men, three children and two women were killed.

September 8, 2008: Two predators fired seven missiles on a small village near Miranschah in Northern Waziristan. 25 humans, mostly women and children, were killed. US officials said that they were family members of Jalaluddin Haqqani, an important commander of the Taliban in Afghanistan.

September 12, 2008: Another drone attack near Miranschah. According to local reports, 14 people were killed and 12 injured in the small village of Tolkhel. The target was said to be an ex-school building inhabited by Pakistani Taliban combatants and their family members.

September 17, 2008: Air attack by drones with four missiles on the village Baghar Schina in Southern Waziristan. According to local reports, seven people were killed and at least three more were injured. The US government claimed that the target was a

Taliban ordnance factory. Only a few hours ago, Michael Mullen, US Chairman of the Joint Chiefs of Staff, assured in Islamabad that the USA respects the sovereignty of Pakistan.

September 30, 2008: Drone attack with a missile on a house near Mir Ali in Northern Waziristan. According to local reports, six people were killed. The reason for the attack might have been that some tribal warriors shot live bullets on the drones which were circling in the area for days.

October 1, 2008: A suspected US drone killed at least six people in a missile strike in North Waziristan, officials said. Two missiles were fired at a house in the Khushali Torikhel area near Mir Ali town at about midnight, according to local media reports. Pakistani intelligence officials said the missiles struck the home of a local Taliban commander.

Oktober 3, 2008: Attack by a drone on the house of Mohammed Khel in Northern Waziristan. 24 people died, including the severely injured who died later in the hospital

Oktober 9, 2008: Attack by two drones on a house in the village of Ghundai in Northern Waziristan. According to local reports, nine people died, five of them were civilians. The attacked house was owned by a man who had some relation to the pro-governmental tribal militia.

Oktober 11, 2008: Drone attack on a house near Miranschah in Northern Waziristan. Five people died, two were injured. According to official reports, the house was owned by a member of the Taliban.

Oktober 16, 2008: A drone fired two missiles on a house in the village of Sam in South Waziristan, an area known to be a stronghold of Baitullah Mehsud, the head of Pakistan's pro-Taliban movement. At least four people died.

Oktober 27, 2008: Peschawar/Islamabad A drone attack on two houses in Schakai / Southern Waziristan in Pakistan killed about 20 people.

December 29, 2008: Suspected U.S. drones fired at least two missiles into Pakistan's Waziristan region on the Afghan border on Monday, killing seven people, intelligence officials and residents said.

September – December 2008: "U.S. forces have carried out nearly 30 air strikes in Pakistan this year, according to a Reuters count, more than half since the beginning of September. The attacks have killed more than 220 people, including foreign militants, according to a tally of reports from Pakistani intelligence agents, district government officials and residents." (Wazir, 2008)

January 23, 2009: Under the new U.S. President Barack Obama the bombing is continued: There was an air attack against a building in Mir Ali in Northern Waziristan, another hit a house in Wana, in South Waziristan. 21 dead people were counted. According to Pakistani media, the house in Wana was owned by a government-friendly tribal elder, who was killed together with many family members such as his three sons and his five-year old grandchild.

Iraq

December 23, 2002: An Iraqui MiG-25 shot down a Predator performing reconnaissance over the no fly zone in Iraq, after the predator fired a missile at it. This was the first time in history an aircraft and an uninhabited drone had engaged in combat. Predators had been armed with AIM-92-Stinger air-to-air-missiles, and were being used to 'bait' Iraqui fighter planes, then run. In this incident, the Predator didn't

run, but instead fired one of the Stingers. The Stinger's heat-seeker became 'distracted' by the MiG's missile and so missed the MiG. The MiG's missile did not miss.

July 2005 - June 2006: the 15th Reconnaissance Squadron fired 59 Hellfire missiles, surveyed 18.490 targets, escorted four convoys, and flew 2,073 sorties for more than 22.833 flying hours. The number of dead civilians caused by these attacks is not known.

U.S. troops are going to train more soldiers for the operation of drones in Iraq and Afghanistan. A high-ranking officer of the U.S. Air Force stated that until 2011, 50 instead of 30 uninhabited aerial vehicles are supposed to monitor Iraq and Afghanistan. At the moment, U.S. forces are testing a new program to train 1100 pilots and operators who will tele-operate so-called predators – uninhabited combat aerial vehicles equipped with missiles and bombs – from their air base in Nevada. (Junge Welt, 2008)

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