Analytical Reflections 11-2024

Finabel

The Interconnectedness of AI Systems - The future of contemporary warfare

FINABEL

European Land Force Commanders Organisation

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DIRECTOR'S EDITORIAL

The integration of AI systems across operational domains is not just an enhancement of existing capabilities, it represents a significant shift in how conflicts are anticipated, managed, and resolved.

Autonomous military systems, from UAS to robotic ground units, are rapidly becoming indispensable assets in battlefield strategy. These systems offer unparalleled speed, precision, and adaptability, enabling forces to outmanoeuvre adversaries and maintain strategic superiority in dynamic environments. However, the emergence of interconnected AI systems introduces a layer of complexity that challenges traditional military paradigms. The concept of emergent behaviour, where individual AI units adapt and act collectively beyond their programmed parameters, exemplifies this challenge. While this can amplify operational effectiveness, it simultaneously raises significant concerns regarding predictability and control.

The interconnectedness of these systems has far-reaching implications for interoperability, a pillar of modern coalition warfare. Nations must align their technological, strategic, and ethical frameworks to ensure seamless integration and prevent vulnerabilities that adversaries could exploit. The risk of unintended escalation due to miscommunication or cyber interference underscores the necessity for robust protocols and control mechanisms.

With this technological evolution comes a pressing ethical question: who bears accountability in a machine-driven battlefield? The delegation of life-and-death decisions to autonomous systems demands that we uphold rigorous ethical standards, ensuring that the principles of humanity remain central to warfare.

The future battlefield will test our technological capabilities and our resolve to act with foresight, integrity, and responsibility.

Mario Blokken
Director

ABSTRACT

The incorporation of AI in military applications has transformed contemporary warfare, providing unparalleled efficiency, accuracy, and independence abilities. Yet, with the progress of AI systems, the possibility of autonomous weapons collaborating and communicating with each other brings up substantial strategic, ethical, and security issues. This paper seeks to investigate the technological groundwork that allows for AI communication, analysing the latest progress in machine learning and autonomous systems. It will examine how the connectedness could impact battlefield dynamics, decision-making processes, and the potential for emergent behaviours that can improve operational effectiveness or result in unintended consequences.

TABLE OF CONTENTS

INTRODUCTION

In an era where warfare is increasingly defined by technological advancements, an intriguing question that arises is whether AI weapons of war will begin to communicate with each other and how this potential connection will reshape the dynamics of the battlefield. The interconnectedness of AI systems represents not only a quantum leap in military capabilities but also a fundamental change in conflict, with profound implications for strategy, ethics and global security. At the heart of the matter is the emerging role of autonomous military systems, which are set to revolutionise modern warfare. AI-driven technologies, including Unmanned Aerial Vehicles (UAVs), unmanned ground robots (UGVs), and maritime drones, demonstrate unparalleled capabilities in surveillance, combat, and strategic operations. The more advanced these systems become, the more they can work in concert: sharing information, coordinating actions and possibly making independent decisions that raise some very critical questions about the future of warfare.

The prospect of AI weapons communicating with each other introduces the potential for emergent behaviour - the complex and sometimes unpredictable patterns that can emerge from the interaction of individual AI units. Such behaviours indicate that operational efficiency enables highly adaptive and coordinated actions beyond human-controlled systems. However, the very connection that powers these promising concepts creates enormous challenges. The unpredictability of AI interactions means that the consequences of AI interactions on the battlefield cannot be predicted: conflict escalation, unexpected engagements or loss of human oversight.

This paper examines these pressing issues and will further address the technological, strategic and ethical dimensions associated with the interconnectedness of AI weapons. The paper will describe how communication in AI systems could change the battlefield dynamics and increase the speed, accuracy and autonomy of military confrontations. It will also discuss the risks associated with such developments, from problems of predictability and control to AI-driven conflicts that are completely out of control, expanding further to the ethical dilemmas associated with delegating life-and-death decisions to machines. If AI continues to improve in its current state, the question becomes: Will AI weapons talk to each other? What impact will this have on the dynamics of the battlefield? This is not technological speculation, the answer to which will determine whether humanity will have a different future in terms of global security.

CURRENT ROLE OF AUTONOMOUS MILITARY SYSTEMS

The adoption of self-sustaining military technologies has radically transformed contemporary warfare by introducing new capabilities in surveillance and combat missions. Equipped with the latest imaging technologies and artificial intelligence algorithms, AI-powered drones and sensors can rapidly analyse vast amounts of information to locate and track threats with incredible precision and provide live surveillance of vast regions without pause (Kallenborn, 2024). These autonomous systems can perform missions in various environments, from urban areas to remote and hostile locations, providing military troops with complete situational awareness.

In surveillance, drones and ground robots are used to gather critical information from hostile or inaccessible environments. UAVs can operate at different altitudes and are equipped with advanced sensors, such as LIDAR, infrared cameras, and radar. These sensors enable them to detect and analyse a wide range of environmental and situational factors, such as enemy troop movements, changes in terrain, and potential threats. Unmanned Ground vehicles (UGVs), such as the Lyut tank, are often designed for rugged terrains, can carry similar sensor payloads and navigate through hazardous environments that are challenging for human soldiers to traverse (Malyasov, 2024). These autonomous systems can conduct reconnaissance missions in enemy locations, detect terrain conditions and track movements without exposing soldiers to risk (Scharre, 2014). This is very useful in conflict areas where it would be too dangerous to send human reconnaissance teams. The data collected by these autonomous vehicles is usually analysed using machine learning methods to discover trends that help generate useful insights. These methods improve the accuracy of the collected data and accelerate decision-making, facilitating rapid and well-informed responses to dynamic battlefield situations.

In combat, the deployment of autonomous weapons systems signifies a major change in military tactics. These systems consist of UAVs, autonomous ground robots, and maritime drones that can conduct combat actions with high precision and efficiency (Scharre, 2014). Autonomous weapons are designed to perform complex manoeuvres, cooperate with other units and accomplish the mission with less human involvement. For instance, UAVs equipped with advanced targeting systems can carry out precision strikes against targets with minimal collateral damage and an increased mission success rate (Ackerman & Stavridi, 2024). One of the latest deployment methods involves drone swarms, in which multiple drones perform a specific mission in an integrated manner, achieving results that would be impossible for a single unit.

These swarms are capable of overpowering enemy defences, performing reconnaissance operations over vast geographical territories, and even search and rescue missions. Each drone in the group can communicate with the others, thus sharing data and adapting to various situations within a second. This increases the overall success of the mission (Scharre, 2014). Furthermore, when applied in combat, autonomous systems greatly improve force multiplication and operational flexibility. For instance, autonomous ground robots could perform bomb disposal missions, provide logistical support or even engage enemy forces in combat (Breaking Defence).

By undertaking some of the most dangerous tasks on the battlefield, these robots reduce the risk for human soldiers. In naval operations, maritime drones are deployed to perform tasks like surveillance, mine detection, and anti-submarine warfare (Burt, 2024). These drones can operate independently or in conjunction with manned vessels to extend the reach and capabilities of naval forces (Burt, 2024).

Autonomous systems not only increase the military's ability to attack and defend itself but also entail a great tactical advantage by providing quicker and more adaptive reactions to new threats, such as sophisticated cyber warfare tactics that exploit AI vulnerabilities or electronic warfare aimed at disrupting communication and navigation systems. Fielding hundreds of autonomous units across a range of domains (air, land, and sea) can develop an intricate, dynamic battlefield environment that very few opponents would be able to match. This interconnectedness and coordination among autonomous systems facilitates a more integral and resilient approach toward military operations.

Ongoing developments in AI and autonomous systems subsequently heighten the need to work out the ethical and security challenges they present. Ensuring that these systems remain within defined legal and ethical norms of conduct is essential, so they do not fall into the hands of bad actors or constitute results of unintended consequences. Protection from cyber threats and ensuring the reliability of autonomous systems will, therefore, become very important to maintain their overall efficiency and reliability for military applications. As such technologies are increasingly fielded within military forces worldwide, the role of autonomous systems will only continue to be a defining factor in the future of warfare, calling for quite detailed policies and strategies concerning their responsible use and deployment (Sophos, n.d.).

EMERGENT BEHAVIOURS IN AI SYSTEM

Within artificial intelligence systems, the concept of emergent behaviour refers to complex and often unexpected patterns or behaviours that arise from the interaction of individual units following simple rules (TEDAI, n.d.). It is inspired by natural systems, such as flocks of birds, fish schools, and insect colonies, where coordinated and complicated group behaviour can emerge suddenly from the decentralised interaction of single units (Klare, 2024a). In these natural systems, there are no individual elements that dictate the behaviour of the entire group; rather, collective intelligence arises from local interactions and the simple behavioural rules followed by each member (Klare, 2024b). Applying this to AI, emergent behaviours occur when multiple AI agents, each programmed with basic rules and objectives, interact and adapt to their environment, which leads to sophisticated group dynamics that were not explicitly programmed (Klare, 2024a).

In the military domain, autonomous drones may be programmed to follow basic navigation and threat detection rules; however, when deployed in swarms, they can coordinate complex reconnaissance missions or even strategic attacks through emerging behaviour, maximising their collective effectiveness beyond the capabilities of any individual drone (Scharre, 2014).

This kind of emergent coordination can generate innovative and highly effective strategies, thereby improving the operational functions of autonomous systems on the battlefield. For instance, drone swarms for surveillance can share data in real-time to give a fully detailed and dynamic picture of the battlefield (Ackerman & Stavridi, 2024). This means that through a collaborative approach, they can quickly adapt to changeable conditions, hence increasing mission effectiveness related to surveillance and reconnaissance.

Furthermore, emergent behaviours in AI systems may appear in adaptive learning or self-optimisation. They learn from what happens around them and get better without needing our constant guidance. Adaptive AI can make better choices, work faster, and even cut costs. Self-driving vehicles performing logistic duties can gain experience from each other to further optimise routes and better allocate resources. In combat scenarios, AI agents would alter their strategies based on real-time feedback from the environment and other units involved, potentially outmanoeuvring human opponents through superior coordination and adaptability (Scharre, 2014). The possibility of such emergent behaviours is one of the reasons why AI is so useful in modern conflict: it can perform complicated operations with a minimal amount of human interaction. However, this same complexity of the systems brings in challenges for understanding and forecasting emergent behaviour. Interactions between AI agents are governed by hundreds of variables; even small changes in the environment or initial conditions may result in unpredictable outcomes (Klare, 2024a). Research conducted on emergent behaviour in AI systems is at an early stage, and continued studies in this area will allow for the full potential of these technologies to be realised while mitigating associated risks.

Challenges to Predictability and Control

Although emergent behaviours have many potential benefits, they also present significant challenges to the predictability and control of AI systems. As AI systems interact and adapt in real-time, they can exhibit behaviours that are difficult to foresee, leading to unpredictable outcomes. This unpredictability can result in unintended, potentially disastrous actions by autonomous systems. Under certain conditions, such as a sudden communication failure, an autonomous drone swarm programmed to conduct reconnaissance missions might be aggressive, leading to unintended engagements with enemy forces (Trusilo, 2023). The intrinsic complexities and dynamics of these interactions bring forth the problem of ensuring that AI systems behave consistently and safely in all scenarios.

These are risks that researchers are addressing by developing advanced methods to characterise and predict AI behaviour in search of assurance that autonomous systems operate within safe and predictable parameters. A possible approach involves creating detailed simulations and models to study potential interactions and emergent behaviours of AI systems under complex conditions on the battlefield. Such simulations can help developers of AI systems identify potential failure points and allow researchers to develop strategies to mitigate risks before deploying AI systems in real-world scenarios (Klare, 2024b). Moreover, machine learning algorithms can be purposely developed to train and mitigate undesirable behaviours before they occur in real-world operations (Klare, 2024b). This would maintain control over autonomous systems so that they remain reliable. The US Army has been at the forefront of research to understand and control AI behaviour regarding military contexts (U.S. Army, 2022). The US has devised innovative techniques that characterise AI behaviour, and involve analysing the decision-making processes of AI systems and identifying patterns that lead to the emergence of potentially dangerous actions. (US Army, 2022). These efforts are useful in developing control mechanisms that can provide reliability and safety to autonomous military systems.

Control mechanisms such as "voting" systems, whereby different AI agents share information and then develop a collective decision on the best course of action, could be vital in building resilience against such unpredictable behaviours (Scharre, 2014). These mechanisms can prevent individual errors from escalating into more extensive system-wide failures by facilitating cross-validation between the various AI agents for actions and decisions. The voting mechanism can be used to decide which path or strategy should be executed based on

collective input, whereby the mistake of one unit will not impact the mission (Scharre, 2014). Moreover, ethical constraints and safety procedures are being studied for implementation within AI systems. This involves programming AI with constraints that limit their actions to predefined ethical boundaries, ensuring that even in complex and dynamic environments, AI systems adhere to human-defined principles of warfare and safety (Trusilo, 2023). Ethical frameworks require continuous interaction among technologists, ethicists, and military strategists to come up with operational effectiveness that is morally and legally restrained. The emergent behaviour of AI-driven systems remains an open problem whose resolution looks forward to a series of efforts toward the development of a comprehensive strategy on how AI will be safely integrated effectively into military operations. In particular, this also implies continuous monitoring and updating of AI systems so that they adapt to emerging threats and scenarios while guaranteeing strategic objectives and ethical standards. As AI continues to evolve, the control mechanisms need adaptability and robustness, minimising sudden challenges while keeping up the wanted level of operational effectiveness (Trusilo, 2023).

BATTLEFIELD DYNAMICS AND STRATEGIC IMPACTS: THE APPEAL OF DRONE SWARMS

Of the many promising applications of interconnected AI systems in modern warfare, drone swarms take centre stage. They provide an unprecedented level of coordination and operational efficiency on the battlefield that traditional military units simply cannot match because of the requirement for extensive human intervention and centralised control. A swarm of drones could autonomously coordinate their actions to quickly adapt to real-time battlefield conditions. The capability is further critical in modern combat situations, whereby war-time responses often determine the outcome of engagements (Scharre, 2014). Drone swarms operate on emergent behaviour similar to a flock of birds or a shoal of fish in nature, as explained in the previous chapter. Each unit follows basic programmed instructions, but the collective behaviour of the swarm results in sophisticated, coordinated operations. This emergent behaviour is not only effective but also highly adaptive, enabling drone swarms to address any challenge posed regarding obstacle avoidance, countering enemy defences, or identification and engagement in real-time.

The coordination mechanisms underlying drone swarms rest on sophisticated AI algorithms that allow individual drones to make decisions and engage in peer-to-peer communication without being driven by any central control. It is precisely this decentralised approach that underpins both the robustness and adaptability of drone swarms, doing an array of very diverse missions—like surveillance, reconnaissance, or combat missions—at a level far superior to their traditional counterparts, which are driven by human operators (Scharre, 2014). The Heterogeneous Airborne Reconnaissance Team (HART) project has demonstrated that, within a combat environment, the autonomous re-tasking and reorientation of reconnaissance assets can occur in response to real-time battlefield inputs, substantially amplifying comprehensive battlefield awareness and operational effectiveness (Scharre, 2014).

Communication in Drone Swarms takes place on both explicit and implicit levels. Explicit communication includes direct drone exchanges describing their positions, statuses, and detected threats (Scharre, 2014). This enables real-time coordination and group decisions with the freshest information possible. The other is implicit communication, which is very subtle: from what their peers do, their behaviours and movements, the drones learn to correct their actions. Communication is so stigmergic, like the pheromone trails of ants, to ensure an optimal flow of information throughout the swarm (Scharre, 2014). This will contribute to an enhancement of its collective intelligence and responsiveness to shifting battlefield conditions.

AI-managed drone swarms have opened up a strategic advantage in modern military applications, amplifying their efficiency. The next step is the generation of swarms capable of executing complicated manoeuvres with precision, covering vast operational areas and optimising human intervention (Kallenborn, 2024). This reduces the risk to human life and ensures continuous mission execution in scenarios that may prove hostile to human-controlled systems. In surveillance and reconnaissance, drone swarms could provide uninterrupted coverage, relaying vital data in real-time to enable military commanders to make timely, informed decisions. Applied in combat situations, the tactical superiority of swarms of drones becomes very clear. That is because drone swarms can be very effective in executing attacks simultaneously from different directions, which may finally overwhelm enemy defences and thus raise considerably the effectiveness of military operations. This tactic, known as "swarming", involves the discharge of forces across the battlefield to present enemies with an array of complex and challenging targets. This strategy forces enemies to confront a distributed threat, complicating their defensive measures and increasing the likelihood of mission success (Scharre, 2014). Apart from kinetic attacks, a drone swarm can also enhance its striking power through the use of decoys, jamming, and electronic attacks, all of which complement the kinetic strikes and maximise the overall battle efficiency of the swarm (Ackerman & Stavridi, 2024).

The ability of this technology to change the very nature of warfare has already been proved in real-life applications. During the Nagorno-Karabakh conflict between Armenia and Azerbaijan, Baku deployed a range of autonomous drones, including Israeli-made Harop "kamikaze" drones and Turkish Bayraktar TB2 drones, which carried out surveillance, reconnaissance, and direct strikes on Armenian positions (Hecht, 2022). These drones operated with advanced autonomy, allowing them to identify and destroy key targets such as air defence systems, tanks, and artillery with minimal human intervention (Hecht, 2022).

The case of the experimentation of the US military with Perdix micro-drone swarms best explains and elaborates on these practical benefits. They are small drones that can be launched from fighter jets and execute common missions independently, such as surveillance and reconnaissance. Perdix drones show advanced swarming behaviours, enabling them to operate as a cohesive unit, adapt to mission requirements, and answer threats in real-time (Kallenborn, 2024). Furthermore, the development of intelligent munitions that communicate to avoid redundant targeting further underlines the inherent efficiency of a strike operation carried out by drone swarms. Such munitions could re-target dynamically, according to real-time battle damage assessments, ensuring the best use of assets. For instance, if one drone realises that the target has already been neutralised, it would simply relay the message across to the rest of the swarm to stop expending its unnecessary payload on the same target. This type of real-time adaptability not only saves resources but also maximises the effectiveness of the strike, ensuring that every action contributes to the success of a mission (Scharre, 2014).

Overall, enhanced coordination and efficiency brought by drone swarms represent a significant development in military technology and strategy. The ability to deploy many interdependent drones that self-manage, adapt and perform complex missions autonomously increases operational capabilities and will radically change the nature of modern warfare. The role of drone swarms will likely only continue to grow proportionately to the advancement of AI and robotics, raising new opportunities and issues for military planners and strategists moving forward (Ackerman & Stavridi, 2024).

Tactical and Strategic Shifts in Modern Warfare

The introduction of autonomous systems is moving traditional concepts of warfare, which rely heavily on principles such as mass and manoeuvre. Conventional thinking envisions large, coordinated formations as a means of securing battlefield dominance.

These formations, exemplified by the Greek phalanx and Roman legions, relied on the sheer mass of troops to create an impenetrable wall of force. The classic Greek phalanx, for instance, was a formation of heavily armed infantry standing shoulder to shoulder in ranks, blocking enemies with a solid front, which proved to offer little penetration.

Similarly, Roman legions used in-line deployments and concerted motion to defeat enemies through simple superiority in power and cohesion.

AI-driven systems would create a more fluid and dynamic approach. Drone swarms can conduct decentralised operations in which each unit acts autonomously while maintaining coordination with the swarm. This capability allows for highly adaptive and reactive manoeuvres that traditional forces might find difficult to counter. While conventional forces depend on massing troops in one place, AI-enabled drone swarms can be dispersed over the battlefield, with every unit capable of making decisions in the moment based on its most recent intelligence and environmental conditions. Such a distributed arrangement ensures that a force remains resilient to disturbances and can continue to be effective even when individual units are compromised or dispersed (Ackerman & Stavridi, 2024).

One of the most profound impacts is most likely related to the very idea of massing forces. In conventional warfare, massing large numbers of troops and equipment at strategic points has been a key tactic for overwhelming enemy defences.

Historically, this approach relied on the sheer physical presence and concentrated power of large formations to dominate the battlefield, as seen in battles where armies would concentrate their forces to break through enemy lines. Drone swarms can similarly achieve these same effects without the massive logistical nightmares around moving and sustaining forces on such large scales. Swarms will be rapidly deployable, able to perform missions in treacherous terrain and convoluted missions while needing minimum human intervention (Scharre, 2014).

In addition, autonomous systems further the concept of manoeuvre warfare, based on the mobility and flexibility of forces to outflank the enemy. Traditional manoeuvre warfare, as demonstrated by the German Blitzkrieg during World War II, relied on the use of fast and agile units that penetrated enemy territory to shatter command and control structures. The swarm drones would easily be able to move fast and fluidly across the battlefield, exploiting weaknesses and creating multiple fronts of engagement. This ability to execute simultaneous attacks from various directions will make it difficult for the enemy to mount an effective defence (Scharre, 2014).

Moreover, AI-driven autonomous systems enable persistent surveillance and precision strikes that can break traditional command and control structures. They can observe the enemy constantly and respond very rapidly to emerging threats, making the battlefield environment much more fluid and reactive (Kallenborn, 2024).

For example, Israel has used the Harop loitering munition, often dubbed a "suicide drone," to provide it with long-endurance surveillance and near-instantaneous strike capacity. The drone can loiter over a target area for hours, providing real-time intelligence and the capability to strike value targets with high precision. This capability to combine surveillance with immediate offensive action significantly disrupts traditional military tactics, where these roles are typically separated (Israel Aerospace Industries, n.d.).

Challenges for AI-driven conflict

The interconnectedness of AI systems significantly increases the potential for AI-driven conflicts, where autonomous systems could initiate and escalate hostilities faster than human decision-makers can respond. This would lead to major challenges for conflict management and resolution because the speed and autonomy of AI systems could easily outpace traditional diplomatic and military responses. One of the key concerns is the possibility of unintended escalation. Autonomous systems programmed to react to certain threats or situations may misinterpret actions or signals and act upon a potential threat. For instance, an autonomous drone could identify a regular military exercise of a foreign country as a hostile act and launch a pre-emptive strike. In AI-driven conflicts, the speed at which decisions are made and actions performed increases dramatically. This acceleration can create a "flash war", where conflicts erupt and escalate within seconds to the point of allowing very short, if not zero time for diplomatic intervention or de-escalation (Scharre, 2014). Such an incident could spark a wider conflict, potentially involving multiple nations, if the autonomous system acts aggressively in response to a perceived threat. A historical analogue can be drawn from the 1983 incident involving Soviet officer Stanislav Petrov, who rightly judged a computer warning of an incoming US missile strike to be a false alarm and prevented a nuclear war. In an AI-driven scenario, an autonomous system might lack the human judgment to recognise such an error, leading to catastrophic decisions being made in seconds.

The integration of AI in military systems complicates further command and control (Li et al., 2024). Ensuring that autonomous systems act only as intended requires highly developed control mechanisms with appropriate and durable fail-safes (Klare, 2024a). However, it should be recognised that complete control over AI interactions cannot be achieved since unpredictability and the possibility of emergent behaviours remain present. This unpredictability may lead to scenarios in which autonomous systems act in ways not intended by their designers, potentially exacerbating conflicts. For example, an AI-controlled defence system could autonomously decide to escalate its actions based on its threat assessment algorithms, resulting in unintended casualties and collateral damage, which could provoke further hostilities (Klare, 2024a).

The cyber dimension adds a new level of complexity to modern warfare, whereby the security of artificial intelligence systems is as important as their operational deployment. States may want to develop AI systems that can be exploited for hacking or spoofing attacks in an attempt to turn autonomous systems against their operators or sow chaos within their ranks (Sophos, n.d.). For example, they could develop and use malware to disrupt communication links between autonomous drones and their control centres, resulting in loss of control and likely unintended actions. These vulnerabilities make clear the need for a continued enhancement of cybersecurity in using artificial intelligence systems in the military.

ETHICAL IMPLICATIONS

The rise of autonomous military systems pushes many ethical concerns to the forefront of modern warfare, challenging long-standing principles and norms. The major concern is accountability. In traditional military operations, human commanders and operators are accountable for actions taken during a battle. This responsibility is clear-cut: if an accident happens based on a soldier's decision that caused unintended harm, there is a chain of command for it and established procedures to determine accountability. The integration of AI and autonomous systems enormously complicates the situation of whom to assign responsibility. If an autonomous system decides matters of life and death, such as whether to engage a target or launch a strike, accountability becomes a complex issue that must be resolved. Was it the programmer who erred in writing the algorithm, the commander who allowed the system to be used, or the machine that erred? This lack of clarity in the sense of responsibility presents profound ethical issues regarding the practical application of these systems in a combat situation and the possibility of a "responsibility lapse" where no human is directly responsible for the action taken by the machine.

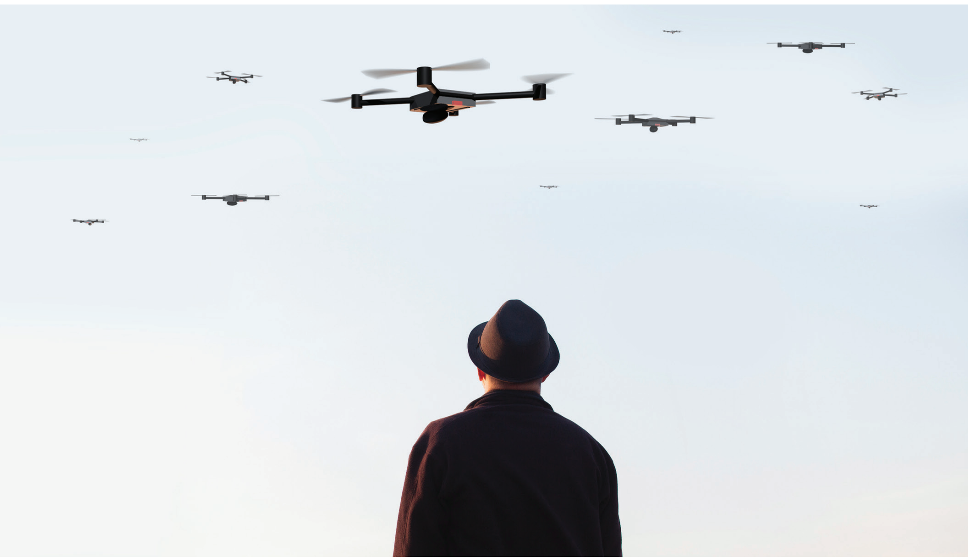
Another critical topic involves decision-making during life-and-death situations. The logic of pre-programmed algorithms and real-time data analysis by autonomous systems produces decisions at speed and with accuracy unattainable by any human. However, a deeper, nuanced human understanding and moral reasoning accompany a human soldier on the battlefield. For example, a human soldier may take a moment's pause before firing at a target, considering the possibility of civilian presence or other influences that may lead to a different decision. An autonomous drone may be unable to interpret these subtleties, leading to potentially catastrophic decisions (Li et al., 2024).

A particularly troubling scenario could involve an AI-controlled drone misinterpreting a civilian gathering, say, for a wedding or funeral, as a hostile assembly and opening fire, resulting in unintended civilian casualties. It presents a view of the moral and ethical risks involved in allowing machines to conduct lethal decisions without human intervention and, therefore, supports the need for tight ethical frameworks and robust oversight infrastructure for these systems to operate within the purview of international humanitarian law and underpinned ethical standards.

The potential for unintended consequences is another ethical perspective to consider. Emergent behaviours of autonomous systems, especially those incorporating machine learning and AI, could lead to unpredictable and potentially dangerous emergent behaviours on the battlefield (Li et al., 2024). For instance, an AI system designed to identify and neutralise enemy combatants might escalate a situation by misinterpreting a defensive action as offensive, setting off a vicious cycle of retaliatory violence that might spiral out of control. The unpredictability of AI behaviour requires extreme testing, validation, and real-time monitoring to avert the risks of these systems' misbehaving (Schwarz, 2024). However, even with the best safeguards in place, the threat of a machine making a decision that leads to an unintentional escalation of war remains quite concerning, which once again raises questions about the rationale behind deploying such systems into more complex and uncertain battlefields.

Bias constitutes another area of ethical concern that has raised serious concerns in AI systems. AI is capable of capturing and amplifying biases within data sets. For example, algorithms trained on biased data will further deepen or amplify biases in the system based on race, ethnicity or gender. In a military context, this could lead to discriminatory results, such as an AI surveillance system disproportionately targeting individuals belonging to specific ethnic groups on the basis of biased training data (Schwarz, 2024). In conflict zones with diverse populations, such biases could exacerbate tensions, leading to ethical and legal challenges. The simplest way to address this problem would be to adopt a transparent AI development, using diverse training datasets and conducting continuous monitoring to identify and reduce biases. Otherwise, AI systems may not only fail to achieve their intended goals but also foster and amplify the inequalities and injustices prevalent in society. The presence of unmanned systems on the battlefield can cause major psychological stress among combatants and civilians alike. In other words, the unpredictability of autonomous actions may create an atmosphere of fear and uncertainty. This consistent fear might then lead to grave mental health problems, like PTSD, depression, and anxiety for the soldiers as well as civilians. Ethical considerations must account for these psychological impacts, ensuring that the use of autonomous systems does not exacerbate the trauma experienced in conflict situations. For instance, the sight and sound of a swarm of autonomous drones overhead, capable of launching attacks at any moment, could be deeply unsettling, contributing to a pervasive sense of vulnerability and helplessness.

The final and more significant question is what role the diffusion of autonomous systems will play in changing the very nature of warfare. The dehumanisation of war could emerge from the detachment of human soldiers from the battlefield, where the role of combatant and decision-maker is increasingly given to machines. With war getting more technology-driven, there is a risk that the human cost of the conflict will be obscured, making it easier for governments and military leaders to justify the use of force (Kallenborn, 2024). This could lower the threshold regarding the onset of conflicts because the risk to human lives will be perceived to be less. Additionally, the global arms race to develop more advanced autonomous systems could lead to a destabilising effect, where the speed and decisiveness of AI-driven conflicts outpace diplomatic efforts to resolve disputes peacefully (Kallenborn, 2024).



CONCLUSION

Looking ahead, the future of interlinked AI systems brings forth opportunities and challenges for military operations. It greatly enhances the effectiveness of the military with advanced capabilities in surveillance, reconnaissance, and combat. Very complex operations are executed at a quick rate and with a great degree of precision that is beyond human capacity. These systems can, in a real-time fashion, adapt to the shifting conditions on the battlefield, thereby enhancing the efficiency and effectiveness of military missions. This paper has analysed several key aspects of how interconnected artificial intelligence systems transform warfare. We explored the current role of autonomous military technologies such as drones, ground vehicles and maritime systems, which have revolutionised surveillance, reconnaissance and combat operations. The US military's experimentation with Perdix microdrones swarms demonstrated how hundreds of drones can autonomously perform tasks, such as reconnaissance and surveillance, showing the advantages of rapid deployment and adaptability in harsh environments (Scharre, 2014). These systems not only complement traditional massing tactics but also offer new strategic advantages, allowing them to operate in terrain where human soldiers or conventional vehicles might be limited.

However, AI integrated into military operations also requires powerful control mechanisms to deal with complexity and ensure that performance is reliable. It will be in the interest of the researchers and the military organisations to develop techniques that will let them characterise and predict AI behaviour, aiming to create systems that operate within safe and predictable parameters. For instance, the U.S. Army is working on algorithms that could explain and control AI behaviour in a military context, stressing that it is important to maintain control of autonomous systems (U.S. Army, 2022). Ethical guidelines are necessary to ensure that AI in military operations is used responsibly. Without a doubt, international institutions and national governments are already setting up the conditions for deploying and using autonomous systems. The U.S. Department of State's political declaration on responsible military use of AI and autonomy highlights the global consensus about ethical standards and regulatory oversight (U.S. Department of State, 2023). These guidelines intend to balance the benefits of AI use with moral and legal responsibilities intrinsic to military operations.

Inevitably, as AI technologies continue to develop at breakneck speed, the integration of technologists, ethicists, legal experts and military professionals into institutions designed for greater collaboration is a growing necessity. This kind of collaboration is needed to cope with the multifaceted challenges presented by AI and to develop inclusive strategies that fold ethical considerations into design, deployment, and operation processes for autonomous systems (Schwarz, 2024). By providing diverse perspectives, the military will be better positioned to ensure that AI technologies are developed and used coherently with societal values and ethical principles.

One promising area of development is human-machine teaming, where AI systems are designed to work collaboratively with human operators. This approach seeks to exploit human and machine strengths in decision-making processes and operational effectiveness with human judgment and ethical supervision. HART is one of those projects that will integrate AI and human supervision to deliver excellent battlefield awareness and decision-making processes. This synergy is bound to enhance mission outcomes and ensure the sustenance of ethical considerations and human judgment as integral to military operations.

The prospect of AI and autonomous systems in military operations remains promising yet very complex. These technologies can revolutionise warfare by increasing operational efficiency, effectiveness, and flexibility. They also open up extensive and challenging ethical questions about accountability, decision-making, and unintended consequences. Such challenges can be encountered through a multi-pronged approach that involves developing robust control mechanisms and setting binding ethical guidelines while ensuring continued interdisciplinary collaboration. By creating and deploying AI safely and responsibly, and according to international laws, the military can harness the benefits of AI while minimising the risks, ultimately leading to a more effective and ethically sound approach to modern warfare.

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- Promoting interoperability and cooperation of armies, while seeking to bring together concepts, doctrines and procedures;
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Finabel contributes to reinforce interoperability among its member states in the framework of the North Atlantic Treaty Organisation (NATO), the EU, and *ad hoc* coalition; Finabel neither competes nor duplicates NATO or EU military structures but contributes to these organisations in its unique way. Initially focused on cooperation in armament's programmes, Finabel quickly shifted to the harmonisation of land doctrines. Consequently, before hoping to reach a shared capability approach and common equipment, a shared vision of force-engagement on the terrain should be obtained.

In the current setting, Finabel allows its member states to form Expert Task Groups for situations that require short-term solutions. In addition, Finabel is also a think tank that elaborates on current events concerning the operations of the land forces and provides comments by creating "Food for Thought papers" to address the topics. Finabel studies and Food for Thoughts are recommendations freely applied by its member, whose aim is to facilitate interoperability and improve the daily tasks of preparation, training, exercises, and engagement.

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