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THE POTENTIAL OF COGNITIVE ARTIFICIAL INTELLIGENCE FOR MISSION-ORIENTED MILITARY DECISION-MAKING

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ABSTRACT

Artificial Intelligence (AI) and Machine Learning (ML) are rapidly evolving and have already had a significant impact on military capabilities, enabling the deployment of new types of assets and tactics. At the same time, there is a need to explore how AI can help commanders make faster and possibly more accurate decisions. The topic of this publication was the exploration of the potential of cognitive AI for mission-oriented command and control. NATO uses the original, well-established term Mission Command in its doctrines, instead of which the author has used the term mission-oriented command method, which is identical in content to the one used in this article.

KEYWORDS: artificial intelligence, mission-oriented leadership, cognitive intelligence, military decision-making

1. Introduction

According to Chinese experts, the use of AI has almost led to a military revolution. In their view, the collection, exploitation and dissemination of information is the most traceable cause of change in military operations. However, they see the greatest danger in the fact that AI systems can accelerate the pace of combat to the point where machine operations can outstrip human decision-making, potentially leading to a loss of human control. A challenge for researchers in military-related research is to solve the technological problems of human-machine interactions, which may include:

- Alignment of purpose between humans and machines. The difficulty of this is that since military systems perform their tasks in a dynamic environment, the goals are constantly changing, so humans and machines must simultaneously navigate the complex environment.
- Humans and machines need to understand the limits of each other's decision space, especially when the objectives change. In this process, humans need to be aware of the machine's design limitations so that they do not have too much confidence in the system, and make adjustments to tasks with these in mind.

However, it should also be seen that we are now in the third AI revolution, which is no longer primarily about technological issues. As former US Secretary of Defense James Mattis (2018) has pointed out, success will not be achieved by nations that develop the technology, but by those that can deploy it. However, a less studied area of the application of AI in a military context is its impact on human strategic decision-making. Therefore, AI developments must fundamentally rethink our concepts of force organisation, command and control. In the light of the current rapid changes, the basic

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concept of leadership (mission-oriented leadership) also needs to be reassessed, because one of the essential elements of the concept of Mission Oriented Leadership will be the symbiosis of man and machine.

This article, as mentioned above, has focused primarily on the more subtle cognitive effects of AI and how they can be used in the decision-making process for the successful execution of military missions. In addition to this, the principles of mission-oriented leadership and other contexts of human decision making in military tasks have been discussed.

2. Basic Concepts for Carrying out Analyses

The concept of artificial intelligence has been defined in a number of ways. In this analysis, we have taken Peter Jackson's definition as a starting point, because the starting point for this definition was cognitive intelligence. According to Peter Jackson (1986): *"Artificial intelligence is the subfield of computer science concerned with the design and application of computer programs that emulate human cognitive abilities such as problem solving, visual perception, and natural language understanding"*.

The starting point for my study was the third level of human intelligence. This level is the level of cognitive intelligence, which includes comprehension, the ability to react, reasoning and finally decision-making, which was the main focus of the research. So far, researchers have been preoccupied with finding solutions for AI that can enable AI to solve problems and make decisions, analyse data, learn concrete things, understand and use natural language, and accumulate knowledge about the world. That is, to see, hear, control movements, work out scenarios, imitate creativity, set new goals independently, or signal a refusal to comply with commands. Cognitive skills such as memory, attention, search, planning, communication, understanding, emotions, self-control, navigation, logical reasoning and modelling can all be resources for strategic decision makers. These capabilities can be enhanced through artificial intelligence and thereby help military decision makers.

The other concept used throughout this study is that of mission-oriented leadership. The current regulations of the Hungarian Defence Forces have also taken mission-oriented command as the basis for discussing the command of military operations, a concept that appears in NATO doctrines as "Mission Command". The term mission-oriented command itself was coined as a translation of the English definition, but different publications translated it into Hungarian in different ways, and the translations may have appeared in different written forms, even within the same publication. The 4th edition of the General Army Doctrine, marked Ált/44 (2018), uses the variants "mission oriented", "task oriented" and "mission oriented" leadership. The Hungarian Defence Forces Land Operations Doctrine (Ált/219, 2015) basically uses the "mission-oriented leadership" form.

In this paper, we have used as a starting point the formulation of Péter Lippai (2009), who states that *"mission-oriented military leadership is the essence of setting a framework goal for subordinates in the tasking process, but not the path to that goal"*. In effect, commanders delegate decision-making authority to subordinates, thus facilitating victory in the race against time. By adhering to the principles of mission-oriented leadership, a goal- and situation-oriented, flexible team leadership can be created. To summarise, and in the words of Peter Lippai, *"mission-oriented military leadership is nothing more than the ability to decide and act independently in response to the situation, in accordance with the intentions of the superior officer"*.

The concept of mission-oriented leadership is considered by NATO doctrine

as the Alliance's fundamental leadership philosophy. The existing NATO doctrines differ in their formulation of mission-oriented leadership, but there are no fundamental substantive differences. Indeed, all current NATO doctrines agree that mission-oriented leadership is NATO's core leadership philosophy and therefore more than a leadership technique or a set of leadership management procedures. According to the principles of NATO's land operations doctrine, NATO AJP-3.2, issued in February 2022, mission-oriented leadership is based on the commander's clearly expressed intent, the freedom of action of subordinates, and the necessity to act even when the tasks originally defined are no longer feasible or appropriate.

Accordingly, AJP-3.2 (2022) has set out five principles of mission-oriented leadership:

- Responsibility, which is at its core the need for clear expression of command intent at all levels.
- Unity of outcome, which depends on a number of factors, including the same doctrinal principles and combat procedures, high quality training, and the proper setting of priorities.
- The principle of freedom of action ensures that subordinates have the right and the duty to seize opportunities and exploit situations.
- The trust and confidence necessary to ensure that the principles set out so far are respected.
- Mutual understanding, which takes time to develop and can only come about through joint training and/or task execution.

NATO's Joint Forces Doctrine AJP-01, published in December 2022, defines mission-oriented leadership as one of four doctrinal principles. According to the doctrine, mission-oriented leadership has two basic elements: trust and mutual understanding. With regard to trust, it emphasises that it is a prerequisite for leadership at all levels of management and is a fundamental determinant of the actions and willingness to act of subordinates. Mutual understanding develops when a high level of consistency of thought processes and actions is achieved within a given bond. Both understanding and trust take time to develop and can only be achieved through shared experience and preparation. The doctrine lists three principles that are essential for mission-oriented leadership:

- unity of effort, ensuring the effective use of available forces and resources to achieve well-defined goals;
- timely and effective decision-making;
- and decentralized implementation.

This can be achieved through effective and timely decision-making at all levels of management. The timeliness of decisions ensures that the initiative is seized and retained. Sometimes, quick decisions in an information-poor situation are less risky than waiting for more information, as it gives the opposing party more time and scope for action. Decentralised implementation allows subordinates to seize opportunities and exploit situations within their own framework, in accordance with the wishes of the superior, in centrally planned and decided operations.

For commanders with fewer resources (human, technical), deep learning, as a form of machine learning, can also be a significant aid to their decision-making. In general, deep learning is machine learning that uses artificial neural networks to enable digital systems to learn and make decisions based on unstructured, unlabelled data. In general, machine learning trains AI systems to learn from experience with data so that they can recognise patterns, make recommendations and adapt. Deep learning allows digital systems to not just react based on rules, but to build knowledge from examples and then use that knowledge to respond, behave and perform like humans. Deep learning relies on layered neural

network architectures, powerful graphics processing units deployed in the cloud or clusters, and large amounts of labelled data to achieve extremely high accuracy in recognising text, speech and images. This extreme efficiency helps developers create digital systems that approach human intelligence. Artificial neural networks, which mimic digital architectures and human cognitive processes, model complex patterns, generate predictions and respond appropriately to external stimuli, in our case, changes in the battlefield. Many types of machine learning require structured data, and the role of neural networks in the planning and execution of military tasks is therefore enhanced by their ability to evaluate events in the external world (the battlefield) as processable data. While neural networks can be considered a form of machine learning, there are some significant differences between neural networks and standard machine learning models that we need to consider in mission-oriented command and control. One is that neural networks tend to be more complex and more capable of operating independently than traditional machine learning models. A neural network, for example, can determine on its own whether its predictions and results are accurate, whereas a machine learning model requires a human engineer to decide this. In addition, neural networks are built to be able to learn and make intelligent decisions on their own. However, machine learning models can only make decisions based on what the model has already been trained to do.

The emergence of mission-driven leadership was long before the information revolution, when radio sets were not even available to managers. In today's world of computerised driving points and digitally driven, short-duration assignments, the way we think about driving has to change with the times. NATO has tried to take account of the new realities of our time in developing its own approach to leadership, but we are now facing an information revolution that could fundamentally change the world as we know it and the recent advances in artificial intelligence research have brought about drastic changes never before imagined.

3. Developing Military Cognitive Skills

After clarifying the basics, I examined the potential impact of AI on mission-oriented leadership, primarily in terms of cognitive intelligence development. However, the topic under consideration is extremely complex. We want to use AI to support the execution of a task in which human lives can be decided by technology, in such a way that the mission is the primary goal. Accordingly, AI supporting military decision making cannot, in my opinion, be an autonomous AI system. The simplest justification for this statement is that humans can never lose control of AI. Accordingly, the goal can only be to find ways in which AI systems can complement human decisions rather than bypass or override them.

Optimising performance in armies often involves the use of technologies and techniques designed to maintain peak performance of individuals and teams in the face of environmental or task-related disruptions. Cognitive performance optimisation strategies can achieve the same goals in the short and long term through precise management, combination and application. For example, providing real-time location updates for hard-to-detect targets can help military personnel optimize gunnery performance while maintaining accuracy and efficiency under stress, load, and uncertainty.

The US Army and other government agencies that work with them, for example, are constantly seeking to gain a competitive advantage over potential adversaries and are considering a number of cognitive development strategies to improve soldier-specific outcomes, such as threat detection,

decision-making, accelerating situational awareness and emotion regulation. To gain this competitive advantage, AI is being used more and more widely. Regardless of the level of generalisation, these research studies on tasks performed in a military context provide a strong basis for applying emerging technologies and methods to improve performance in applied contexts. A wide variety of methods can be used to enhance cognitive performance, and results are already being shown in the US. Each approach targets a subset of perceptual, cognitive and affective processes and as such has its own particular limitations and challenges to implementation. It is not yet known what the trade-offs are between improving some performance while potentially reducing others. This may particularly apply to brain stimulation approaches that alter the demands on metabolic resources in certain brain regions, possibly reducing their availability to other brain regions that may be relied upon to perform tasks. This fact may also be critical for mission-oriented designs because, in addition to trade-offs at the individual level, trade-offs in performance at the team level must also be considered. For example, it is possible that increasing the performance of some team members due to increased expectations may unintentionally negatively affect the overall performance of the team. Conversely, it is possible that previously underperforming team members may experience increased motivation from high performing team members. Based on the results of currently known research, we can say that future research at the intersection of social psychology and cognitive psychology must take into account the complex team dynamics that can develop when individualized development approaches are used together and can have a decisive impact on setting goals.

But emerging development research shows that no single development technique delivers the same results for everyone in all contexts and tasks. True performance improvement must go beyond aspects of human cognitive ability, emphasising the importance of achieving accurate baseline peak performance measures as a basis for comparison. Without such measures, it is difficult to ensure the effectiveness of improvement programmes and to distinguish between optimisation and further improvement, which stimulate further research. Finally, the choice of development techniques to be applied in training and operations presents a number of challenges that guide and constrain the design and application of tools. These include the unique training requirements for appropriate device use and maintenance, the networking requirements of battlefield devices, and the interaction and integration with existing hardware and software on or around wearable and portable devices. Given the challenges and the potential of emerging technologies and techniques, research can be conducted in several directions.

To emphasise the importance of military cognitive skills even more strongly, we used the results of a study conducted by the Malaysian army. The research focused on the concept of military cognitive readiness. The motto was General George Smith Patton's words, *"Wars may be fought with weapons, but they are won by men"* (Ratcliffe, 2016). Interestingly, General Patton also essentially formulated the principles of mission-oriented leadership. This was his formulation: *"Never tell people how to do things. Tell them what to do, and they will surprise you with their ingenuity"*. The Malaysian Army has formulated its future development plans in the Malaysian Defence White Paper (MDWP, 2020), emphasising not only the importance of physical training, but also the importance of moral and cognitive force development. Arguably one of the most important aspects for military personnel in terms of human performance is the emphasis on cognitive development.

Human resource experts in military organizations must also keep in mind the training environment and deployment needs when preparing military personnel for contingency operations. Training of military personnel should be viewed in its design as part of the process of ensuring that military personnel learn things that they do not know but that are necessary for military operations. It is essential that they are able to apply this knowledge in a creative way, even if technical tools (computers, AI) are not available. Critical thinking must be developed during training to enable military personnel to think creatively and deliberately. This critical thinking enables the military to analyse the battlefield environment, which provides the opportunity to assess emerging trends and identify potential vulnerabilities or threats. By critically analysing the nature of war, military personnel can also gain insight into ways to improve future planning and problem-solving processes to find effective solutions to complex challenges, thus ensuring optimal 'human' performance of soldiers.

4. Transforming Mission-Driven Leadership through AI

Mission-oriented leadership is therefore not a new invention, as it may have been present in the history of warfare from very early times, while in institutionalised form it has existed since the end of the 19th century, but at the latest since the first half of the 20th century. This philosophy of leadership defined certain principles which, when followed, allowed the military organisation to be effectively led. However, the application of these principles has been influenced by the possibilities that have been expanding thanks to constantly evolving technological tools, the culmination of which is artificial intelligence.

The emergence of artificial intelligence can affect all aspects of mission-driven leadership. One of the fundamental goals of mission-oriented leadership is to ensure that subordinates have the opportunity to act when they lose contact with their superior or when the task assigned to them is not effective, but the superior's objective can be achieved by other means, using different resources. However, decision-making supported by modern tools can reach a speed and complexity that only tribes of the right size and with the right training can achieve.

Commanders at lower levels (platoon, company, battalion) may not have a tribe of sufficient size and technical conditions at their disposal. As a consequence, decisions taken in an information-poor environment, although timely, may be fatal without an adequate understanding of the operational environment, possibly based on erroneous assumptions. It can be particularly dangerous if decision-makers are forced to deviate from pre-developed plans, because commanders may then resort to their own limited experience or to schematic solutions from the rules of engagement, thereby narrowing the options for implementation. Computers and AI solutions can also address these situations by speeding up the decision-making process and enabling subunit commanders to make informed decisions. The aim of this decision-centric form of warfare is to make mission-oriented leadership more effective by creating a command and control system in which people decide and lead, but artificial intelligence takes the lead to maintain speed. In this case, humans and machines should be able to work together in a wide variety of configurations and circumstances, with decisions being made by humans but tasks being distributed by a machine. The possibility that an artificial intelligence could perform the task allocation, the formation of casual ties, raises several questions. It is certain that there will be a need for trust between the human and the controlling machine, and in all cases the human must understand the intentions conveyed by the machine. At the

same time, if the task imposed by the AI cannot be accomplished under the circumstances, will the effects of the actions of subordinate commanders who take the initiative and act, applying mission-oriented principles, be able to be managed by the AI that is supervising and distributing the tasks? However, the principle of decentralised implementation can be undermined if the higher level overrides the lower levels with its immediate communication possibilities, or if it changes and clarifies its decision in rapid succession. In this case, the lower level of management may be transformed from an autonomous initiator to a mere executor-supervisor, thus moving further away from the role of the human factor.

5. Conclusions

Artificial intelligence is a particularly important area for NATO (McGee-Abe, 2022). However, decision support systems based on artificial intelligence also carry other risks than mere incomprehension and the difficulty of joint human-machine task execution. With large amounts of information coming in, battlefield systems can create a real-time, near-perfect situational awareness that allows senior leaders to directly lead their subordinates' subordinates by replacing their direct superiors. In the operational environment of the times to come, the concepts envisage the own forces as a system of links and devices connected in a vast communication network. In such a fully interconnected system it will be much easier to direct subordinates by direct orders. Technical advances are creating the conditions for this, but if this happens, we can no longer talk about mission-oriented leadership, or even command-oriented leadership, since in this case the leader with a complete situational picture can ignore the leadership structure.

Even so, the mission-oriented leadership philosophy may be pushed into the background and sacrificed on the altar of speed and efficiency. If armies become more autonomous systems and fewer people, mission-oriented leadership will not necessarily be the main leadership method, at least not in its current form. One of the most likely next steps in AI research and military development will be to integrate or replicate systems currently on the market to create a command and control automation system that does not fundamentally affect the principles of mission-oriented command and control.

As more advanced and effective solutions from the civilian sector find their way into military systems, more and more advanced AI-based systems are becoming available to control assets and support decisions. Automated weapon systems using artificial intelligence will have a fundamental impact on mission-oriented command and control in the sense that more time and experience may be required to achieve the necessary confidence. Innovative application concepts, such as mosaic warfare, which also takes into account the results of multispace operations, envisage systems using artificial intelligence that will be able to distribute tasks between humans and machines according to the intent and resolve of the single commander, depending on who is in the best position to produce the right effect. This possibility further raises the issue of mutual understanding and trust. My research has led me to the conclusion that the increasing use of artificial intelligence is inevitable in future warfare, as it is one of the basic prerequisites for maintaining a decisive advantage over the adversary. The one who has the decisive advantage can impose his will on the other, can keep the upper hand. However, in order to effectively apply the prospective artificial intelligence-based decision support or management systems currently under development, it is necessary to thoroughly elaborate the legal and ethical regulatory

framework on the one hand, and to refine the technical solutions and research new technical innovations on the other. On the basis of the above, I have concluded that the basic principles of mission-oriented leadership are not changed by artificial intelligence, they are equally valid in a mixed human-machine relationship, but their implementation may require different kinds of training, adapted to modern technical developments, and the limitation of artificial intelligence. As automation and artificial intelligence develop to even higher levels, it is possible that humans will be the decision-makers in military operations, and that the battle will be fought by self-propelled machines. In this case, mission-oriented leadership as such will be transformed, and algorithmically built-in mutual understanding and trust will no longer be factors. Until that point in the perhaps not so distant future, however, further development of mission-oriented leadership is necessary, and training of personnel in this direction is crucial.

However, it is also important to note that the current powerful and efficient AI-based systems are extremely resource-intensive, i.e. they require high computing power and storage space, which is not cost-effective to provide in smaller commands and may not be possible at current technology levels. In addition, there will be an even greater need for a robust encrypted data link, which, although theoretically existing, in practice has been used to break most of the secret communications throughout history. At the same time, we cannot ignore the disruption that can be caused by interference in the transmission of data. The solution may lie in the emergence of efficient, small-scale quantum computers, which, combined with artificial intelligence, could fundamentally change the world as we know it today.

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