THE SAME SYSTEM WITH DIFFERENT AND ADDITIONAL SUPPORT SYSTEMS – THE POSSIBLE FUNCTIONS OF AI IN WARGAMING

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Absztrakt

UGYANAZ A RENDSZER KÜLÖNBÖZŐ ÉS KIEGÉSZÍTŐ TÁMOGATÓ RENDSZEREKKEL – AZ MI LEHETSÉGES FUNKCIÓI A HADIJÁTÉKOKBAN

A professzionális hadijátékok egyfajta reneszánszukat élik, mint elismert és rendszeresített eljárás mind hazai, mint NATO-s szinten. Ezzel párhuzamosan az egyre inkább teret hódító mesterséges intelligencia (MI) is kiemelt kérdéskörré váltak a védelmi szférában. Jelen tanulmány a szakirodalmat áttekintve azon kérdésre keresi a választ, hogy MI-alapú eszközök és rendszerek miként és hogyan alkalmazhatóak a professzionális hadijátszás területén, különös tekintettel a potenciális veszélyekre és korlátokra. MI-rendszerek elősegítik és gyorsítják a hadijátékok tervezését, lejátszatását, illetve annak elemzését is, ugyanakkor a szerzők hangsúlyozzák, hogy ezt csak bizonyos korlátozásokkal érdemes alkalmazni. A szerzők rámutatnak, hogy háború, és így a hadijátszás emberi tényezője továbbra is meghatározó marad, a mesterséges intelligencia nem helyettesíti, hanem helyesen alkalmazva támogatja azt.

Kulcsszavak: mesterséges intelligencia, hadijáték, döntéshozatal

Diszciplína: hadtudomány, informatika

Abstract

Professional wargames are undergoing a renaissance as a recognized and systematized procedure at both the domestic and NATO levels. At the same time, artificial intelligence (AI), which is becoming increasingly prevalent, has also become a key issue in the defense sector. This study reviews the literature to find answers to the question of how AI-based tools and systems can be applied in the field of professional wargames, with particular regard to potential risks and limitations. AI systems facilitate and accelerate the planning, design, execu-tion, and analysis of military wargames, but the authors emphasize that their use should be subject to certain restrictions. The authors point out that war, and thus the human factor in wargames, remains decisive; artificial intelligence does not replace it, but rather supports it when used correctly.

Keywords: artificial intelligence, wargaming, decision making

Discipline: military science, informatic

In this short article, the authors discuss the relationship between wargames and artificial intelligence (hereinafter referred to as AI) and try to figure out if it is worth it or even right to use AI in wargames. It may seem surprising at first, but this question is not primarily a technical one, but rather a civilizational one. Why? Because the application of AI in war-

games is actually just a testing ground for how far humans are willing to outsource their thinking and the responsibility for their own thinking. Warfare has always been the most acute form of hu-man decision-making; if the human mind begins to disappear there, sooner or later it will follow suit in all other areas...

Before delving into the questions surrounding AI, it might be useful to spend a few paragraphs explaining wargaming itself. These terms are so in vogue today in military science, lectures, and articles. They are mentioned and emphasized in countless places, but do we know and understand what they actually mean? Well, this is not such a simple question, because if, for example, we search for Hungarian-language articles and studies on the internet, we will find that there are few such writings and authors. Unfortunately, this means that it is not nearly as common a topic in Hungarian military culture as it is in other armed forces. At the same time, the alliance is placing increasing emphasis on the use of wargames to help maintain its deterrence and resilience against potential adversaries.

With regard to AI the NATO 2022 Strategic Concept states that emerging and disruptive technologies (or, more simply: emerging technologies), including AI, present both opportunities and risks that affect the nature of conflicts and have strategic significance (NATO, 2022).

If we look up the term wargaming or wargame, we find countless definitions. Perhaps one of the most comprehensive and easily understandable definitions for "non-experts" can be found in a synonym dictionary. According to this: "Wargaming is an activity in which military forces or other organizations participate in a simulated war or conflict situation in order to test their strategies and decision-making processes. During this process, participants practice military operations in a virtual or real environment, taking into account various factors such as terrain, weather, enemy strength, and their own resources..." (Szinonimák.hu). So, this is an activity performed by soldiers. Basically, yes, but the issue is not that simple. A few lines later, the editors emphasize that "wargames are not only useful for military forces, but also for other organizations and institutions..." (Szinonimák.hu). Indeed, it can be said that the principles and procedures developed over the centuries can be useful for anyone or any organization that wants to "foresee" future processes, decisions, or their consequences as accurately as possible. However, the authors base their approach on the conceptual approach set out in the NATO Handbook, according to which: "Wargames are representations of conflict or competition in a safe-to fail environment, in which people make decisions and respond to the consequences of those decisions" (NATO, 2023, p.8.). As can be seen from this, human input is a central element of wargaming, which consists of the following:

- the players,
- the decisions they make,
- the narratives they create and shape,
- the experiences they share,
- the lessons they learn (Doktrinzentrum der Bundeswehr, 2024).

The "safe-to-fail" environment characteristic of wargames refers to the fact that the decisions made by people have no direct physical impact on reality, meaning that it is possible to explore, within a safe framework, where the various decision alternatives lead, what their effects and risks are, and how and why a given situation can be lost or won, which are the characteristics that justify the emerging trend of wargames (UK Ministry of Defence, 2017).

In the following chapters of this study, after a brief historical overview, we will exam-ine whether – taking into account the risks and limitations – artificial intelligence can be used in wargaming as it is currently practiced, and if so, in which areas. In addition to outlining the possibilities, we will, of course, pay special attention to the potential negatives, dangers, and ethical issues, and we hope that in the last chapter, the reader will find logical answers to the questions posed in the first paragraph.

The early days of wargaming

Previously, we referred to a process spanning several centuries. The question may arise: where did this "science" begin? This is difficult to determine, since – quite understandably – since the dawn of human history, all warring parties have desired and continue to desire to know the plans and future activities of their opponents, so that they can take appropriate and effective countermeasures against the actions of enemy... but above all, they have wanted to surprise the enemy with moves that would allow them to seize and maintain the initiative. In almost all cases, this is the key to success and victory.

Several board games known today date back to ancient times, the most famous of which is chess, which remains popular to this day. In some respects, these can be considered the precursors of wargames, but since they were all quite abstract, we cannot really speak of wargames in the modern, professional sense (Somkuti, 2021). Among military themes, one of the earliest examples was the Indian game Chaturanga, which dates back more than two thousand years and included the Indian weapons of the time: elephants, cavalry, chariots, and infantry (Sabin, 2014). Jumping forward in time, we arrive at the early 1800s... to Napoleon, who was probably influenced by a board game that appeared a few decades earlier, which, albeit in a rudimentary form, featured various factors such as terrain, weather, logistics, and dice.

According to records, the French ruler was one of the first to use different coloured blocks to designate troops, and since 1811, alongside Georg von Resswitz's numerous scientific innovations, blue has been used to designate friendly forces and red to designate the enemy. Resswitz's other innovation was that for instance, unlike in board games, teams did not immediately fall off the board but remained on the "battlefield" until their destruction, albeit with continuously decreasing strength or numerical value. Subsequently, after the Franco-Prussian War ended in a sweeping Prussian victory, the procedure spread among the world's armed

forces, and the emergence of professional wargames for military use in the modern sense can be traced back to the Prussian Kriegsspiel of 1824. Earlier games related to the theme of war were primarily designed for entertainment purposes, while Kriegsspiel, which focused on military decision-making and was based on topographical maps, was simulative in nature and was able to convey the fog of war (Nebels des Krieges) to participants (Pielström and Wintjes, 2019).

Prior to World War I, the future adversaries conducted numerous wargames simulating potential wars. For instance, even before the world war, wargames were part of the planning of major operations based on German doctrines (Caffrey, 2019). During the Great War, the interwar period, and World War II, wargames were used as a respected tool. The US Navy took this to such an extent during World War II that, according to them, nothing came as a surprise to them during the war except for the kamikaze pilots (UK Ministry of Defence, 2017).

After World War II, wargames underwent a transformation. In Western countries, led by the US, interest in wargames declined and shifted toward computerization. In the 1960s, wargaming regained popularity and took on a political-military dimension. In the 1970s and 1980s, it continued to develop and become more institutionalized, with a focus on computer-assisted analysis coming to the fore (Caffrey, 2019). Simultaneously, civilian wargames created for entertainment purposes also enjoyed great popularity starting in the 1970s.

At that time, on the eastern side of the Iron Curtain, wargaming continued to develop less in the direction of computerization and more in the traditional direction. In the Soviet Union, data collected from World War II was used to increase realism and make wargaming as realistic as possible (Caffrey, 2019). Hungarian wargaming, like military decision-making as a whole, was characterized by Soviet procedures, which placed emphasis on well-prepared military decision-makers, while the relatively small staff simply relayed orders to subordinate units. In this process, wargames were intended to develop the decision-making abilities of military leaders on the one hand, while on the other hand preparing the staff to implement the above procedures (Harangi Tóth, 2019). In the final years of the Cold War, in a spirit of dé-tente, joint US-Soviet military exercises were held, in which wargames were used as a confi-dence-building measures (Caffrey, 2019).

Currently, the use of wargames is highly regarded at NATO level, and at the same time, an increasing number of member states are implementing capability developments in this area. In the Hungarian Defence Forces, wargames are used as part of the Military Decision Making Process, mainly in the comparison of developed courses of action (Harangi Tóth, 2019). It is also part of Hungarian military higher education, where it appears from BSc to the Military Senior Leadership Course.

In terms of their use, we can distinguish between professional and commercially available wargames. However, due to the focus of

this article, the authors present the phenomenon of wargaming without claiming to be exhaustively comprehensive. Within professional wargames, we primarily refer to those used by the defence sector, but wargames are also present in business and other policy areas. Military applications by the defence sector can be categorized based on three fundamental characteristics: purpose of use, level of military operations, and time period appearing in the scenario (Caffrey, 2019). Depending on the purpose of use, they can be analytical or educational. The purpose of analytical wargames is to support decision-making, typically by facilitating the systematic analysis of complex situations, revealing new connections, interactions, and possible consequences, or by generating data. Educational wargames help develop decision-making skills and are a useful tool for both current and future leaders.

But what can wargaming be used for in practice? The Handbook of the Bundeswehr, for instance, defines the following areas of application: decision-making support, increasing mental resilience, and innovation (see: Doktrinzentrum der Bundeswehr, 2024). In supporting decision-making, wargaming appears as a qualitative method, enabling comprehensive examination of complex problems and providing a better information base for decision-makers, for instance, the aforementioned "CoA wargaming." This is particularly effective when combined with quantitative methodology. The use of wargaming increases mental resilience through cognitive learning. Factors such as fear of failure, poor organizational culture, or social pres-sure have a negative impact on decision-making (see: Doktrinzentrum der Bundeswehr, 2024). Organizations operating under strict hierarchical structures, such as the armed forces, are charac-terized by a culture of victory, in other words, intolerance of defeat and mistakes, as well as an unconstructive attitude towards the questions and opinions of subordinates in the hierar-chical system. In the field of innovation, wargames can promote the development of new ide-as and approaches, as a well-organized and well-facilitated wargame can enable participants of different ranks and positions to work together and share their opinions, thereby strengthening creative thinking (Doktrinzentrum der Bundeswehr, 2024).

The potential roles of artificial intelligence in wargames

It is worth clarifying the place of AI in our world and some basic questions at the beginning of this study. Artificial intelligence is not a piece of software or a specific product, but rather a scientific discipline, an increasingly independent and growing field of science. For the sake of clarity, it is worth approaching the issue in this way. Another important question is the existence of AI itself.

Contrary to the general belief, we can currently only work with Artificial Narrow Intelligence (ANI) systems, which, when used properly, are quite effective, but are also task-

specific and cannot be applied to multiple tasks without human input or intervention. It is worth to note that although large language models (LLMs), which are frequently used today, appear to be generally applicable, they are in fact part of narrow AI. To our knowledge, artificial general intelligence (AGI) and artificial super intelligence (ASI) currently exist only in theory, and it is uncertain whether human science will be able to create AGI and subsequently ASI (USMA Library). Just as we can only have vague ideas at present about whether the answer is yes, we also have vague ideas about when and how this might happen. Despite the many questions, we must also consider these possibilities, so it is possible (and certainly worthwhile) to design a wargame with the specific aim of mapping out the po-tential effects and dangers of AGI or ASI with the involvement of experts. It may already be apparent from these few thoughts that the relationship between AI and wargames is two-way: we can use wargames to examine the development of AI systems and their impact on warfare, for instance, but we can also use AI tools to design, execute, and analyse wargames. It is important to note that the primary purpose of these systems is to supplement and support human input, not to replace it.

Lastly, it might be worth raising a slightly philosophical point, namely that in the future we will probably have to distinguish between strong and weak AI. Strong AI refers to truly intelligent, self-aware intelligence, while weak AI pretends to be intelligent (University of Helsinki and MinnaLearn, 2018). At present, we can only talk about weak AI systems, but the future will definitely see the creation of "strong" systems.

Below, we will dive into how AI can be used in the various phases of wargames, without claiming to be exhaustive.

Planning and designing wargames, creating scenario

The creation of different scenarios is a crucial issue, because scenario generation is the point, and the opportunity where AI truly enters the realm of wargame creation, not merely as an analyst, but as a story-creating partner. Humans can intuitively come up with one scenario, maybe two or three... but AI can generate a huge number of them in a short period of time. It does this by taking into account the enemy's previous behaviour, various reconnaissance and intelligence data, logistical and weather factors, and basically anything else.

The narrative of a wargame is essentially an imagined scenario, a potential conflict situation that players bring to life with their decisions. If this scenario is created by artificial intelligence, then it becomes the "scriptwriter" and, at the same time, the shaper of the framework for thinking at all three levels of warfare in a way that is more complex than human capabilities and, in fact, probably more accurate and much faster.

And now consider how AI should support existing military wargaming systems at three different levels of warfare.

At the strategic level, the task is actually to create an entire world, with a fictional or real-

life political background, federal relations, economic conditions, time frame, theatre of war, etc. Here, the role of AI is to collect data, simulate the consequences of political decisions, and create realistic geopolitical narratives. Nevertheless, current AI systems often over-simplify complex political processes, tending to underestimate the role of irrationality, brain-storming, and intuition in human decision-making... and this is certainly a serious limitation.

At the operational level, the composition and position of friendly and enemy forces, command intent, objectives, physical and temporal constraints of the theatre of operations, as well as logistical, communications, morale, weather, and other conditions are determined.

An AI method must assist the staff in the creation of simulated counterparts of real units, vehicles, and tools, weather and terrain modelling, automatic force deployment based on the characteristics of real weapon systems and doctrinal principles, as well as previously learned knowledge and force assessment. AI methods are already easy to use in these areas today, as the data is available and the models can be taught. The problem here is rather that AI does not always understand "intent," meaning that it knows what can happen, but does not always understand why.

At the tactical level, AI may be capable of performing realtime tactical simulations (movement of units at the squad, platoon, or battalion level, fire support, etc.), even in space, and modeling probable outcomes (e.g., combat, supply shortages, detection interference). As a result, it must be able to redesign the scenario if the situation changes unexpectedly (e.g., logistical failure, weather disaster), thereby offering staff members alternatives that they might not have thought of themselves, for instance: "What happens if the enemy attacks six hours earlier?" "What happens if ammunition supplies are reduced by 20%?" etc.

As a result of using AI methods, military staff can see not just two or perhaps a few, but hundreds of possible scenarios – the worst-case scenario and the most likely scenario must always be worked out –, which they can play out in a matter of minutes, as a simulation within the whole procedure. This generates a huge amount of new data and information in almost every case, which also needs to be analysed and evaluated with the help of AI, for example, by searching for patterns that remain hidden from the human eye and mind.

Execution of wargames

Accelerated probability analysis. In tradi-tional wargames, participants explore only a few courses of action, but AI can generate and play out many more in a matter of minutes. The Monte Carlo method is a stochastic simulation method that uses computer tools to generate the final result of a given experiment, after which the numerical characteristics obtained as a result are recorded and evaluated. The error in the result is determined by calculating the standard deviation. Using Monte Carlo simulation, it can generate probability distributions: e.g., the probability of success, fail-ure, or partial

success. This gives decision-makers a more statistical-based picture of which alternative is the most viable, but for now, these are just numbers…

The use of AI models can be useful during a wargame, assisting the staff in assessing the probability of success of the actions proposed by the participants, thereby "lifting" some of the burden from the facilitators and adjudicators and making the scenario flow more smoothly.

One common reason for scepticism about wargames is the use of dice, which are often used to determine the outcome of a decision. However, it is important to know and understand that wargame designers do not use this method arbitrarily but rather based on mathematical probability calculations and modifying factors related to the given topic, while also incorporating the phenomenon of chance into the mechanics of the wargame. In general, war-games are designed so that numerous factors can modify the outcome of a dice roll, such as resource allocation, differences in capabilities, circumstances, and so on (see: Harangi Tóth, 2020). This is therefore the result of thorough work by wargame designers based on scientific knowledge, taking into account the aspects of realism and the functionality and playability of wargames... and by no means just "guesswork"!

Unfortunately, in today's seemingly digitized, sometimes "over-digitized" world – although the bitter reality of the Russo-Ukrainian war provides countless examples to the contrary – when we try to improve everything sometimes recklessly with various computer systems, the mention of dice is tantamount to frivolity for many military leaders, as for many it may initially bring to mind board games designed for children, where the success of each decision seems to depend solely on luck (Petrovánszki, 2023). An AI-based tool could be a solution here too, as participants are more likely to accept the "result thrown" by artificial intelligence (since it is already "digitized" and therefore acceptable) than if we did the same thing with dice, due to their (sometimes excessive) trust in technology.

Western military culture, especially the American and British approaches, relied much more on intuition, situational awareness, and decentralized initiative, accepting that in reality not every decision can be optimized, while AI – like Soviet-style commanders – seeks to optimize, always looking for the best combination. The Soviet Union's decision-making culture was highly centralized and formalized: they tried to measure every variable. They were much better at this than their Western counterparts, and it was effective in the short term (e.g., artillery planning, logistical synchronization), but in the longer term, it made thinking rigid, unable to keep up with changes.

At present, AI does not seem to understand that human commanders/leaders often deliberately choose suboptimal solutions when they prioritize surprise or psychological superiority over rationalism. The biggest methodological dilemma of AI-supported wargames is: what do we measure and how, if the "best decision" is not always what the

algorithm considers optimal? It is also worth considering what "best decision" actually means. After all, while AI takes into account and examines loss minimization, the time factor (achieving the goal as quickly as possible), the efficiency of resource utilization, and the level of risk, human deci-sion-making also involves unexpected events, psychological effects, moral and political issues, or the conscious desire to "not choose the most obvious option."

It seems that this is the borderline... AI decisions may be rational, but they may not necessarily be wise, which is also a powerful warning! A "wise decision" may not necessarily yield the best result but rather attempts to envision the least bad future. This is a different type of thinking, as it does not optimize, but rather anticipates.

The correctness of decisions cannot be quantified or measured precisely, and we believe that it is not worth attempting to do so, even with the help of AI. Instead, the focus should be on examining the correctness of the decision-making process, on how data-driven, understandable and analysable, time-efficient, flexible, and ultimately... creative it was. If we do so, AI can be of enormous help in quantitatively supporting or rejecting decisions that need to be made using human intuition. The system is able to quantify these parameters, but interpreta-tion remains the task of humans.

Cognitive support and visualization. We concluded the previous section by stating that interpreting measured and quanti-fied values is a human task. We do not wish to refute this idea, but it may be useful to examine how an AI-supported system can not only display data, but also significantly assist human thinking, situation recognition, and decision-making... with visual tools. This can reduce mental load and increase the speed of situational awareness and pattern recognition. AI does not think for humans, but – if used correctly – it can assist human thinking.

How can this be achieved? AI displays events in real time and, if necessary, can add verbal explanations (e.g., in 3D terrain, AR glasses, interactive maps, audio), thereby creating more transparent and understandable circumstances. Thus, the staff not only receive a set of data, but also see a picture of the situation in the present and the probable future. Therefore, visualization is not just an image, but also an act of communication.

Generative AI products are already being used to support the design and execution of wargames, making the wargaming itself more realistic on the one hand, and allowing additional material such as news, reports, images, and so on to be added immediately to the course of events on the other.

It must be able to suggest decision points, critical bottlenecks, and effects that may not be obvious at first glance, which the human mind or eye often fails to perceive. It is very important that the staff has the opportunity to ask "questions" and simulate assumptions with AI, for instance: "Show me what happens if the second battalion is delayed by 30 minutes."

Visualization is not meant to make people think less, but rather to help them see more

clearly where and what is worth thinking about. The essence of AI support is not technologi-cal, but rather cognitive... like a "digital chief of staff" who keeps order among the infor-mation in the commander's mind. Visualization becomes truly cognitive support when people no longer look at the data but see and understand the meaning of the situation. The point, then, is that the wargame should "captivate" the participants as much as possible, allowing them to immerse themselves in it.

If the system is able to do this, the result will be a more transparent, intuitive analysis that will enable the commander to respond and make decisions more quickly and perhaps more accurately.

AI, as: wargamer, leader of the opposing force. An artificial intelligence-supported system must be capable of simulating realistic decision-making on the part of the enemy, rather than simply "playing" according to the doctrinal principles we have created. With the help of AI, it is possible – and necessary – to incorporate the personality traits of enemy commanders into behavioural models, but this should be done in a simplified, well-validated, and human-supervised manner. The goal is not to completely reproduce the human psyche, but to model decision-making preferences and reaction patterns for the purposes of wargames. Thus, instead of providing specific responses, AI is able to adapt flexibly to losses, deceptive manoeuvres, changes, and so on. In addition to all this, we must also mention one of the main characteristics of wargames, namely that playing a wargame multiple times from the same starting position will always lead to different results, high-lighting new opportunities and threats (UK Ministry of Defence, 2017). The system is able to continuously learn from these variations, essentially "training itself" like an artificial wargamer who becomes more prepared, more skilled, and gains more knowledge with each run. How does all this happen?

A well-calibrated virtual adversary commander can offer three major advantages to the wargame system. First, the staff will face a more realistic opponent, as the system does not repeat exactly the same pattern as a rule-based simulator would. The next thing is its ability to adapt much faster than humans, which allows it to react more quickly, thus posing a serious challenge to human commanders and staff. And finally, it should not be forgotten that systems operating in this way are constantly learning, so they become more accurate after each game because their experiences are continuously incorporated into their decision-making models.

Obviously, the question arises: if we try to model the decision-making of the opposing party – a human – as realistically as possible, who or what is best suited for this task? And this brings up countless other questions... A person who is an expert on the subject, or an AI wargamer? Can the knowledge of a Subject Matter Expert (SME) be replaced by an AI player? Are the decisions of the opposing party human at all, or do they rely heavily on AI suggestions? And so on... difficult questions, questions to which we can only guess at

the answers today, but at the dawn of this era, we do not yet have sufficient usable information about all of this. However, it already seems certain that the use of an AI wargamer can be useful when there are not enough participants with the right qualities, or when a substitute participant is needed to represent neutral actors (neutral forces, non-governmental organizations, or civilians).

One of the critical factors in the effectiveness of wargames is traditionally the ability and knowledge of the participants. However, in practice, SMEs on a given topic are often overburdened and not always available, which can be remedied, for instance, by the use of Large Language Models. In addition, the use of artificially generated data from wargames allows human players to learn about other perspectives, thereby discovering new possible solutions (Jensen, Atalan and Tadross, 2024).

Another crucial aspect – which generally applies to war as a whole – is that decision-makers must make decisions in an environment where not all information is available, or where there is a distinct lack of information, leading to what is known as the Fog of War. As Clausewitz expressed it: "…every war is rich in particular facts; while, at the same time, each is an unexplored sea, full of rocks, which the General may have a suspicion of, but which he has never seen with his eye, and round which, moreover, he must steer in the night." (Clause-witz, Howard (ed.) and Paret (ed.), 1976, Book II, Chapter 2). Whether we use AI methods for scenario planning, decision support, as a wargamer, or analysis, the fog of war can always arise. Managing this uncertainty is a key issue. One of the best solutions for this – which is used by most AI systems – is probability calculation. This makes uncertainty a little more tan-gible and quantifiable, which AI is able to handle, especially when large amounts of relevant data are available (University of Helsinki and MinnaLearn, 2018).

Nevertheless, the most worrying issue is not the functioning of AI, but humans themselves. This raises a very serious psychological and ethical question: what happens if leaders and staff begin to copy the machine and its decision-making? If this happens, it may even be that the work of staff becomes more efficient in theory, people may learn to make decisions faster, but they will consider less... they may even forget that warfare still takes place on the battlefield today and is also a very serious moral issue.

The authors do not wish to suggest that the use of AI is dangerous or should be avoid-ed when simulating hostile activity. Not at all. Indeed, it is worthwhile and even necessary to exploit the enormous potential it offers... but this must be done sensibly and consciously. And in this case, awareness means control. In the future, AI systems should be operated with three restrictions:

• The first area is the "ethical filter" built into the AI system that "plays" the enemy. This filter must screen out suggestions that are humanly, legally, or politically unacceptable to one's own armed forces or those of the opposing party. Creating and maintaining this is very difficult and not specifically a military

task. However, without it, the problems outlined above may arise during wargames, which will ultimately compromise the entire decision-making process. The question may also arise as to what a right is or just decision from a moral point of view. To what extent can such a subjective question be quantified? Jus ad bellum and jus in bello can be taught through machine learning... but how will they be applied in a wargame? In order to model reality with fidelity, we must also take into account the fact that the opposing party may not be bound by our moral standards. Therefore, it is important to emphasize the statement made a few sentences earlier, that the enemy must play by its own rules, even if they seem foreign to us.

• The following issue, as a continuation of the previous one, is the explainability of AI activities. This means that systems must be designed in such a way that AI is required to explain all of its decisions. Humans must be able to evaluate this explanation in every case and possibly reject it, even if it has already passed the first filter, the "ethical filter." At this point, however, humans assign a task to AI on how to proceed from a certain decision point. This is a difficult but necessary question.

• Finally, barriers to the need for continuous human approval must be built into the system. This will likely slow down the process, but it is crucial to ensure that the actions of the AI-wargamer are truly "human." However, it is critical to understand that the person approving decisions made by an AI tool must actually consider them and not purely rely on them... just accepting them (Rivera et al. 2024).

And lastly, a highly philosophical question that is still a long way off. An AI commander is not a "real" opponent until it has intent. Intent, however, requires many human qualities, such as a value system. A human commander makes decisions because they want to achieve something. An AI probably makes decisions because it wants to maximize something. It would truly become a "commander" if it were able to understand why it wants to win, but that may go beyond the question of artificial intelligence and into the realm of artificial will... which is probably already at the level of artificial superintelligence?

There is another concern regarding the implications of using AI-based systems as players in wargames or to support decision-making. Hunter and Bowen argue that current narrow AI systems based on machine learning are fundamentally unsuitable for the command decision-making required in warfare, as their operation is based on inductive logic – that is, the recognition of past patterns – whereas the essence of decision-making from the tactical and the strategic levels is abductive reasoning, i.e., decision-making characterized by uncertainty and the fog of war (Hunter and Bowen, 2024).

To this add that models can study, for instance, Clausewitz's work or other military thinkers' "timeless" works, but will they be able to display the phenomenon of "military genius" described by him during a wargame? We do not know. Can models replace real

military experience gained "firsthand" with probability calculations and conclusions based on large data sets? We cannot know this for sure either...

Analysis, evaluation of results, or learning and lessons identified and learned

At its current level of development, an AI system is able to record the results of hundreds or even thousands of previous wargames in a database, and with the help of machine learning, it refines its internal worldview with each run and each replay, increasingly better estimating what the outcome of certain situations might be. In addition, it recognizes which activities, patterns, and doctrinal procedures lead to success or failure and reduces the randomness of its decisions. We could also say that it becomes increasingly "confident" because unfamiliar situations will increasingly resemble something it has seen before, and it will make similar decisions based on identical inputs. It can then use this growing "knowledge" in subsequent wargames.

Therefore, unlike human staff, the more we "play" the system, the smarter and more sophisticated it becomes... instead of becoming tired. This sounds very nice, but is it really true?

Indeed, there are several issues. The first is mathematical in its aspect. The develop-ment presented above is statistical in nature... current AI presumably does not understand what it is learning, but rather its knowledge increasingly accurately matches past patterns, so the "intelligence" of AI is not a deepening of thought, but rather a refinement of statistics. However, it logically implies that machines will become better at data, while humans will become better at interpreting things.

The second area to consider: when talking about AI systems "learning" is misleading. Human learning often develops through mistakes, irregularities, and surprises. AI cannot "learn" from mistakes in the sense of understanding why a mistake occurred... it only statistically adjusts the metrics so that it does not happen again. Machines learn from repetition, hu-mans learn from interpreting contradictions. The system develops in terms of accuracy, while humans – hopefully – develop in terms of meaning.

The third area of concern is "mental state." AI can run continuously, never gets bored, never gets stressed, never changes its strategy... based on mood. Although this requires significant resources. On the one hand, this is an advantage, but on the other hand, it is also a cognitive disadvantage, because human fatigue, doubt, and mood swings are not mistakes, but learning fluctuations: these are the moments when the decision-maker breaks their routine. The machine, on the other hand, never questions its own logic, it only refines it. The commander, however, sometimes consciously does not believe in statistics, and this is precisely what creates the unexpected.

Overall, it can be concluded that the more we use the system supported by AI, the more it develops. It develops because it creates more accurate patterns and makes more stable, reliable predictions. However, it is

almost certain that AI systems at their current level will not become more intelligent in the human sense, because they do not know the "why," only the "how"; they do not learn to think, they only become better at calculating. And finally, they will not become wiser, because wisdom is the ability to recognize contradictions, which machines are likely to see as errors.

An AI method can therefore learn about combat and armed conflict, but it does not actually learn how to wage war. Humans learn to wage war but often forget what they previously knew about war. The more we "play" the system, the more accurate its probability estimates become, the more consistent its behaviour becomes, and thus the less novelty it will bring, because it has already seen everything that its model allows. However, if we try to teach the machine not only the results but also the reasons behind human decisions, then the system not only "learns" but also "reflects," and this comes close to true artificial intelligence. The two – human and machine – can become truly powerful together, because then the AI remembers and the human interprets.

Although professional military wargaming is the focus of this paper, it is worth men-tioning that this topic does not only cover the issue of warfare, as for instance deescalation, peace operations, and human security are equally important from a military perspective. Therefore, the military application of wargames is not strictly limited to combat. For instance, a wargame focused on peace-making requires a completely different logic, set of criteria, and decision-making process than, say, "testing out" course of actions. In the former case, the hu-manitarian focus, social dynamics, and a broad interpretation of security come to the fore, while in the latter case, the emphasis will be on the application of doctrinal principles and the practice – and, if necessary, modification – of combat-level procedures. Based on this, the AI tool used will also need different data and inputs. It follows that AI-based solutions cannot be applied uniformly in the same way in every military exercise but must be adapted to the context and the desired outcome.

The benefits of using AI

When we look at modern armed conflicts, we see that the speed of events has long since exceeded the pace that the staff can keep up with manually, using their creative and analytical minds. The speed of information flow is usually measured in fractions of a second, not minutes or hours. A human staff is simply not capable of processing and interpreting this amount of data. This is a situation we must accept and try to deal with. Restructuring staff and increasing their numbers is only a solution to a certain extent. The use of modern communication tools and computer technology is only an aid; it does not fundamentally solve the problem. AI is therefore probably not a luxury, but a necessary neurological aid, or, so to speak, an improvement to the central nervous system of the armed forces. If we do not take this into account and perhaps decide not to use AI, it is not a morally superior

approach, just a slower one... In the wars of the future, it is certain that the speed of thought will be the fire-power itself.

The current culture of wargames has been around for decades, even centuries, because the human mind could still "see through" the system: a few units, a few manoeuvres, predictable intensity, known enemies. The wargames of the 18th and 19th centuries took place on the board, those of the 20th century on the map, and those of the 21st century increasingly in the data space... This is not a question of romanticism; science always develops with the help of the tools available. Today, some types of wargames are – for the most part – too complex to be held together by human imagination alone. AI is the only tool capable of handling statistical uncertainty and logical coherence at the same time at this scale. Although we have to note that this cannot be applied to all types of wargames, for instance, the rules and mechanisms of matrix wargames are less rigid and rather enhance on creativity and brainstorming.

It should be noted, however, that there is another side to this issue. The push towards digitization may overlook the human aspect. Analog wargames will continue to be used. These are important because, among other things, they have advantages that no software seems to be able to replace. It is more enjoyable for players to be able to touch the pieces and markers, as this allows them to participate actively in the course of the wargame, immerse themselves in it more deeply, and place greater emphasis on personal interaction.

And although the battlefield has always been multidimensional – only the number of dimensions varied in different era – today, an unmanageable amount of data is generated in every "dimension." The kind of intuition and insight that comes from experience, which we have interpreted as military genius in almost every era, is no longer enough. It is necessary, but not sufficient for success…

In earlier periods of warfare, individual commanders could exert a decisive influence, even though war was always complex. Today, however, due to complexity and vast data flows, quantitative processing itself has become a strategic capability. A wargame can focus on any time period in the past or distant future. For instance, it can explore a past conflict for educational purposes, or it can focus on the near future to support decision-making in relation to a current conflict. A well-planned and well-designed wargame – if it wants to and is able to predict the future – has to run through millions of combinations. Humans cannot do this because their attention, time, and energy are limited. AI, on the other hand, is tireless, or at least much less prone to fatigue than humans... we do not know this for sure yet. It is not needed because it has a better understanding of military science, but because it is able to perform repetitive thinking tasks that humans cannot do at the speed required today. This frees human decision-makers from the drudgery of analysis and thus truly supports us in our decision-making.

Indeed, this will likely result in a completely new situation, as there is no reason to assume

that if we use AI, our enemies will not do the same. Therefore, in wargames, it is not enough to model human opponents – we also need simulations of AI against AI. So, in the 21st century, human commanders are not only fighting against the human decisions of the enemy, but also against the evolution of machine strategies.

Let us now return to humans for a moment. Humans tend to forget their mistakes. This is even more true in military institutions... failures are rarely part of the curriculum, and in many cases are almost a political burden, something to be forgotten. AI, on the other hand, is able to learn from every mistake, since every wrong decision or incorrect reaction is actually data. Wargames can be built on mistakes, which are not failures but feedback – unwanted outcomes, deviations in the process. This is not very appealing, but it is certainly useful in the long run. Military science cannot renew itself if the past must be hidden and ashamed of. AI is not ashamed; rather, "it" archives.

At this point, we have arrived at an important aspect of wargaming. During wargaming, the emphasis is not on winning at all costs and ensuring that the opposing side loses, but rather on how and why we did not win, which is often a valuable result in itself (Harangi-Tóth, 2020). What were the factors, decision points, and shortcomings that led to "not winning"? And it does all this in a safe-to-fail environment where we can learn even from the outcome of a losing without any real losses.

And now consider another human concern... Military history is replete with tragedies caused by the overconfidence of commanders. The human mind loves to believe that it can control chaos. The introduction of AI will put an end to this illusion, and humans will be forced to admit that they do not fully understand the decisions made by complex systems. Understanding this is essential for understanding and controlling the battlefields of the future. However, once we understand this, AI will not take away human power but rather realize its limitations and make it more sustainable. In a world where war can paralyze global infrastruc-ture in minutes, excessive human overconfidence is a greater danger than machine coldness.

The integration of artificial intelligence should not be about machines making decisions and humans accepting them, but rather about combining the two forms of thinking mentioned earlier, analytical and intuitive, into a single system. And this is where wargames become really important, as this is the arena where this cooperation can be safely experimented with and then practiced. While machines learn from human decisions, humans learn from machine logic. This is not subjugation on either side, but a kind of alliance, let's call it a cognitive alliance, perhaps the first truly new type of human-technology relationship in strategic thinking. This may be an accurate statement, as more and more people today – including the authors themselves – are insisting that the domains should be supplemented with a new one: the cognitive domain.

We believe that if we do not integrate AI, we will not preserve humanity or human dominance, but rather human limitations. And history has always shown that those who cling excessively to their limitations will sooner or later perish among them.

Limitations and risks

AI – as it currently stands – appears to be able to help us cope with the incredible dynamics of the battle and the enormous amount of data. But before we start thinking that this will solve all our problems at a stroke, we must also mention the expected downsides.

The above described factors provide significant assistance in the planning, design, execution and analysis of wargames played within the framework of military decision-making. Nevertheless, we should not ignore certain concerns. These concerns stem from the most fundamental differences between humans and AI. An AI "wargamer" is not human, so it may interpret various basic concepts, such as "victory," differently. At the current level of development of these systems, it is safe to say that their decisions, or the decisions they recommend to humans, do not yet have a moral dimension; that is, they do not understand the concept of "too high a price," for instance. It is possible that if the probability of success increases, AI would be able – at least today – to make (or recommend) decisions that are unacceptable to humans. It will probably not fear loss, it will have no emotional barriers, so it may be inclined to follow the principle of "maximum risk, maximum profit," which human commanders – without emotion – are incapable of. However, this means that simulating its activity cannot be realistic either. For an AI commander, war, combat, killing, and loss are not yet a tragedy, so AI will probably always be logical, but not always reasonable... and the difference between the two would be measured in human lives on the real battlefield.

AI-based tools are able to process data and information and performing analysis and evaluation at unprecedented speeds and volumes, but they can also potentially slow down decision-making, as they generate even more data and information for decision-makers to consider, raising further questions (Carnegie Endowment for International Peace, 2024).

When using AI tools in wargames – as a wargamer or decision support – it is also important to consider how this might affect the very human group dynamics. During wargames, participants find themselves in decision-making situations. Imagine, for example, that in such a decision-making situation, participants have to come up with a solution, and an AI "player" also comes up with a proposal. To what extent will participants be inclined towards the AI's point of view and proposal as a result of excessive trust and reliance on technology? And if one of the experts on the subject, even if they have a different opinion, questions the solution proposed by the AI, will they do so? It is more than likely that when a group has to make a

decision in a short period of time, there will be a strong urge for participants to follow the recommendations of the AI "player" (see: Carnegie Endowment for International Peace, 2024).

Perhaps an even bigger concern is excessive reliance on AI, where the staff members uncritically accept AI outcomes and recommendations, thereby eliminating creative and critical thinking. If the staff rely too heavily on the "wisdom" of AI systems, cognitive courage, the kind of intuitive boldness that is often at the heart of critical decision-making, may indeed decline.

In wargames, AI is not primarily a simulation tool, but rather an aid to human decision-making, which is also an influencing factor. For this reason, however, any errors, distortions, or misinterpretations can have serious consequences. If AI recommends a course of action in a way that cannot be understood, explained, or analysed, the command staff will likely treat it with caution. In the case of AI systems, interpreting natural human language can also pose problems. For instance, due to multiple meanings, AI systems may encounter difficulties in correctly interpreting the instructions they receive. However, research is already underway to address this issue (Schadd, 2022).

The accuracy of the data entered can also be a serious source of concern. If the initial data is incorrect or does not fully reflect reality, the system's simulation, answers to questions, and recommendations will also be distorted.

Finally, there is a lack of creativity. Current systems think in terms of learned patterns and do not "think outside the box." This means that they will probably continue to lack intuition for a long time to come. However, if AI learns from its own past, sooner or later its worldview will become closed, so the algorithm will learn from the same patterns over and over again and preserve its thinking logic, which poses two dangers.

AI starts from existing patterns and data and is likely to consider those successful that previous human staff considered successful in their staff work. In doing so, the system effectively elevates the doctrines of the past to the norm and interprets true novelty as a statistical "anomaly." The other danger is a bit more philosophical, but it's worth thinking about. If an AI-supported system works from the past and isn't prepared for the future, it'll probably know everything about what's already happened and less about what never will... At the same time, it can recognize trends on a statistical basis and making predictions based on probability, but it does so based on existing data, so it will not be able to incorporate data it does not yet have into its probability calculations.

Machine learning involves processing extremely large amounts of data, which ultimately – at least for now – originates from the human world, meaning that the data sets inevitably contain distortions that will also be evident in AI models, producing discriminatory features (Leavy, O'Sullivan and Siapera, 2020). This carries numerous risks; just think of a wargame with a geopolitical theme. What negative impact could it have on its fidelity and results if, for instance, the AI

tool adopts a Western-centric (or any other) worldview because that was predominant in the data set?

Another issue related to machine learning is that it can be an extremely costly process, especially if we want to create a complex system, while in wargaming it needs to be flexible and modifiable so that it can be used in other scenarios or for other purposes. For this reason, it may be preferable to use „smaller" modular AI systems in wargames (Ryseff and Bond, 2022).

A 2024 study examined the military and diplomatic decision-making behaviour of five large language models – extending to the use of nuclear weapons – within the framework of wargames, which yielded extremely thought-provoking results. All of the models examined were more prone to escalation – to varying degrees – than human participants, and this often manifested itself in the form of sudden escalation that was difficult to predict. In addition, they tended to provoke an arms race... both conventional and nuclear. With all these decisions, the models typically justified deterrence and first-strike tactics. One possible explanation for this tendency toward escalation, according to the authors, is that publications related to escalation predominate in the international literature, so the models, learning from the written material, adapted this focus (Rivera et al. 2024). The escalatory behaviour of the models suggests that decision-making based solely on statistics and probability calculations is insufficient, as non-material aspects such as human life must also be taken into account.

This tendency toward escalation also poses a risk when AI is used to support decision-making, as it can influence the decision-maker's views in an unintentional and subtle way, and raises further questions about the logic behind decisions made by such models, which is not entirely transparent (Barzashka, 2023). All of this once again highlights the need for an "ethi-cal filter," explainability, and human approval with critical thinking in mind. As with any new innovation or tool, we must ask ourselves to what extent we want to rely on it. There is a noticeable trend towards the digitization of wargames and, in parallel, AI-supported wargaming, thus marginalizing manual wargaming, even though, as already men-tioned, it also has its advantages. If we rely too heavily on AI-supported processes and decision-making, how will this affect resilience if, for instance, an unexpected event causes the AI-based tool to become tempo-rarily or permanently inoperable…

When weighing up the limitations and risks, we may be inclined to conclude that this involves too much risk, but we should also consider what might happen if we neglect such an innovative development. When exploring the integration of AI tools into wargames, it is worth bearing in mind that developments in this area are not limited to NATO member states. The People's Republic of China has made significant capability developments in both AI and wargames in recent years and continues to do so today. For instance, AI systems are being used to develop wargames with complex scenarios (Black and Darken, 2023). Consequently, both at NATO

and national level, developments and research in this area are essential in order to the alliance to maintain its competitive edge over potential adversaries. Failure to participate in such innovative processes could potentially result in falling behind.

There is lively professional debate around the world on how to mitigate or completely eliminate these limitations and risks. Some experts see hierarchical reinforcement learning as the solution. This is an extension of traditional reinforcement learning, which attempts to address limitations by introducing a hierarchical structure into the learning and decision-making process. Its central element is that complex, longterm tasks are broken down into smaller, more manageable subtasks in a hierarchical system. As part of this, the AI system can apply multiple models depending on the situation, thereby optimizing decision-making and action strategies (Black and Darken, 2023).

Further research will definitely be needed in terms of limitations and risks so that AI systems can be used in the most optimal and innovative way possible in the field of wargaming.

Summary
– new dimension and looking ahead

AI is beginning to have an impact on warfare today, and it is almost certain that it will generate very significant changes in the near future, along with other EDTs. For this reason, the new systems are sure to have a significant impact on military operations as well.

In the foreseeable future, armed conflicts will still mainly involve human actors, so their main characteristics will remain virtually unchanged, despite ongoing minor changes. In the short term, machines will not take over or "want" to take over the role of humans in plan-ning, organizing, decision-making, or execution, so for the time being, we must not forget Clausewitz's basic principles. However, there is a real danger that, despite the fact that machines do not yet have a will of their own, we ourselves will unwittingly hand over some of our roles and responsibilities to them... because it is more convenient, faster, and more precise. This is not necessarily a bad or harmful process, but – as in so many areas of life – a healthy balance must be found here too. If we fail to do so, we may end up living with a perfectly optimized system that knows everything about warfare except one thing: what people do and why, why people wage war...

The next issue concerns the very existence of AI. The roots of research in this field actually go back to Alan Turing, and since then it has experienced countless ups and downs. There was a period that we now refer to as the AI winter, but today we are witnessing and participating in an unprecedented boom. It has become fashionable not only to work on, re-search, and develop AI, but also to talk about it. We ourselves are doing just that now... However, it is worth considering whether this research and development will yield any serious results. Is artificial super-intelligence, or even AGI even achievable in the near future? Could there be another AI

winter, or, on the contrary, can we expect further major breakthroughs? One thing is certain – as already mentioned – the capabilities of existing AI systems already have a significant impact on warfare, and AI research will be decisive for future warfare.

Decision-making, and its speed and accuracy, is always a crucial issue in warfare. In developing this, innovative approaches such as the use of AI systems in wargames, where decision-making is the central element, are unavoidable. As has been demonstrated, AI-based solutions can effectively and in many ways assist in the planning, designing, execution, and analysis of wargames, while also accelerating these processes.

A key question is how this can be implemented most effectively and what the first steps of initial implementation should be. The authors of this study believe that it is worthwhile to first integrate AI-based solutions into smaller-scale wargames, the results of which can then be incorporated into more complex wargames. and at the domestic level, it is definitely recommended to monitor efforts in this direction within the alliance and to learn from them, adapting them to our culture if necessary.

As emphasized several times in the paper, the use of AI-based solutions in wargames should only be introduced with the restrictions discussed, i.e., taking ethical considerations into account. Particular attention must be paid to ensuring that the AI system is always able to explain its decision proposals, that humans can follow the steps leading to the proposal, and that human approval is an integral part of the process. These are unlikely to be easy tasks, but they are essential for effective and efficient application in order to reduce or even eliminate the risks described above.

The authors believe that, alongside digitization and the use of AI systems, we must not forget about analogue wargames, their advantages, and the role of humans. From what has been described so far, it is clear that we are still a long way from the optimal situation, so we recommend further research into wargames and AI systems, with a particular focus on mapping the development of AI systems and their impact on warfare, for instance.

In conclusion, let us assume that AI tools will be successfully and effectively integrat-ed into the wargaming procedures of our own and our allies in the near future. With this assumption, we can also be sure that potential adversaries are researching and developing this capability, so it is likely that if we succeed, they will too. Innovative developments of this kind certainly take time – in terms of procedures, technology, and personnel – so if their de-velopment does not begin in time, it cannot be made up overnight. Falling behind is not an option, either domestically or within the framework of the alliance in general.

The integration of AI into wargames may carry potential risks, but its absence will clearly lead to disadvantages. The future of warfare is not a question of human or machine, but whether we are able to elevate thinking as a biological function to a technological capability and whether we will be able to apply

innovative solutions effectively... The successful strategist of the future will no longer be the one who is good at math, but the one who is able to think together with an intelligent system while preserving the one thing that machines – it seems – will not learn for a very long time:

the shame of responsibility.

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