CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Political Studies

Department of Security Studies

Master's Thesis

Artificial Intelligence as the upcoming Revolution in Military Affairs

The cases of the United States and China through the lens of Strategic Culture

2022 **Vittorio Macagno**

CHARLES UNIVERSITY

FACULTY OF SOCIAL SCIENCES

Institute of Political Studies

Department of Security Studies

Master's Thesis

Artificial Intelligence as the upcoming Revolution in Military Affairs

The Cases of the United States and China through the lens of Strategic Culture

Name: **Vittorio Macagno**

Academic advisor: Mgr. et Mgr. Tomáš Kučera, Ph.D.

Study program: Master's in international security studies (MISS)

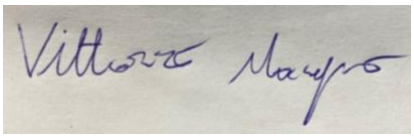
Year of project submission: 2022

Length of the thesis: 138.157 characters

Declaration

1. I hereby declare that I have compiled this thesis using the listed literature and resources only.
2. I hereby declare that my thesis has not been used to gain any other academic title.
3. I fully agree to my work being used for study and scientific purposes.

In Prague on May 3rd, 2022 Vittorio Macagno



Reference

MACAGNO, Vittorio. 2022. *Artificial Intelligence as the upcoming Revolution in Military Affairs. The cases of the United States and China through the lens of Strategic Culture*. Praha. 70 pages. Master's Thesis. Charles University, Faculty of Social Sciences, Institute of Political Science. Department of Security Studies. Supervisor Tomáš Kučera

Acknowledgments

First and foremost, I would like to thank my supervisor, Tomáš Kučera, for his support and assistance throughout the entire process of this thesis. I would also like to thank all the other Professors at Charles University who have taken the time to help me with this project and who have inspired me throughout these two years.

A very special thank you goes to my good friend and colleague Noé, who has always been there to encourage me throughout the good moments and the bad ones, and without whom this project would have not been possible. In like manner, I am very grateful to Martina for her assistance with my thesis, as well as for her general moral support throughout the entirety of this Master's degree. I would also like to thank Sophie, for the great help she gave me in finding crucial information for the success of my work.

Finally, I cannot begin to express my gratitude to my family, who has supported every decision I have made that led me to this moment, and who has always encouraged me to pursue my passions, even when this has meant being apart for long periods of time.

Abstract

Artificial intelligence is nowadays a key element in many people's everyday life. Since its beginning, this technology has grown leaps and bounds, drastically revolutionizing everything it has touched throughout its developing process. Arguably, every aspect of society has more or less been impacted by artificial intelligence. Military affairs do not appear to be immune to this, with many examples of this technology's implementation in this field appearing more and more. However, it appears likely that the effects experienced so far by countries' military affairs are still quite limited, with the technological potential of artificial intelligence bound to drastically change military affairs altogether. So much so that it can be even argued that artificial intelligence has the potential to completely revolutionize them. For this reason, one may argue that this technology could be the upcoming Revolution in Military Affairs. This thesis will look into this specific idea, aiming to prove that the world is witnessing the coming of a new Revolution in Military Affairs, based on artificial intelligence.

To verify this idea, the methodology this work will make use of consists of taking all of the three levels of war one by one, to then analyze the revolutionary potential that AI has in transforming each one of these. This process will be carried out through secondary document analysis.

Technological potential alone, however, is not enough to prove whether we are witnessing a new Revolution in Military Affairs. Especially in regards to artificial intelligence, it is crucial to also look at the social environment in which this technology is implemented as well. To look into this, strategic cultures of the two countries that appear to be the leading powers in this field, the United States and China, will be analyzed and compared to one another, highlighting the key differences between these two nations.

The research carried out through this paper highlights the existence of an upcoming Revolution in Military Affairs based on artificial intelligence, with specific elements that can be found to different extents in both countries. Strategic culture is key in understanding why different elements are more or less present in different countries, hence becoming necessary in understanding the potential of the topic at hand alongside the analysis of its technological potential.

Title: Artificial Intelligence as the upcoming Revolution in Military Affairs. The cases of the United States and China through the lens of Strategic Culture.

Keywords: Artificial Intelligence (AI), Autonomous weapons system (AWS), China, Cyber warfare, Information warfare, Operational level, Revolution in military affairs (RMA), Strategic culture, Strategic level, Tactical level, Technological potential, Three levels of war, United States.

Abstraktní

Umělá inteligence je v dnešní době klíčovým prvkem v každodenním životě mnoha lidí. Od svého počátku tato technologie rostla mílovými kroky a drasticky změnila vše, čeho se během procesu vývoje dotkla. Každý aspekt společnosti byl pravděpodobně více či méně ovlivněn umělou inteligencí. Zdá se, že vojenské záležitosti vůči tomu nejsou imunní a stále více se objevuje mnoho příkladů implementace této technologie v této oblasti. Zdá se však pravděpodobné, že dopady, které dosud zažívají vojenské záležitosti zemí, jsou stále dosti omezené, přičemž technologický potenciál umělé inteligence je nucen zcela drasticky změnit vojenské záležitosti. A to natolik, že lze dokonce tvrdit, že umělá inteligence má potenciál je zcela převratně změnit. Z tohoto důvodu lze namítnout, že tato technologie by mohla být nadcházející revolucí ve vojenských záležitostech. Tato práce se bude zabývat touto konkrétní myšlenkou s cílem dokázat, že svět je svědkem příchodu nové revoluce ve vojenských záležitostech, založené na umělé inteligenci.

Abychom tuto myšlenku ověřili, metodika, kterou tato práce použije, spočívá v tom, že vezmeme všechny tři úrovně války jednu po druhé, abychom pak analyzovali revoluční potenciál, který má AI při transformaci každé z nich. Tento proces bude proveden prostřednictvím sekundární analýzy dokumentů.

Samotný technologický potenciál však nestačí k prokázání toho, zda jsme svědky nové revoluce ve vojenských záležitostech. Zejména v oblasti umělé inteligence je klíčové podívat se také na sociální prostředí, ve kterém je tato technologie implementována. Abychom se na to podívali, budou analyzovány a vzájemně porovnány strategické kultury dvou zemí, které se zdají být vůdčími mocnostmi v této oblasti, Spojených států a Číny, přičemž budou zdůrazněny klíčové rozdíly mezi těmito dvěma národy.

Výzkum provedený prostřednictvím tohoto příspěvku zdůrazňuje existenci nadcházející revoluce ve vojenských záležitostech založené na umělé inteligenci se specifickými prvky, které lze v obou zemích v různé míře nalézt. Strategická kultura je klíčem k pochopení toho, proč jsou různé prvky více či méně přítomny v různých zemích, a proto se stává nezbytnou pro pochopení potenciálu daného tématu spolu s analýzou jeho technologického potenciálu.

Title: Artificial Intelligence as the upcoming Revolution in Military Affairs. The cases of the United States and China through the lens of Strategic Culture.

Keywords: Artificial Intelligence (AI), Autonomous weapons system (AWS), Čína, Kybernetická válka, Informační válka, Operační úroveň, Revolution in military affairs (RMA), Strategická kultura, Strategická úroveň, Taktická úroveň, Technologický potenciál, Tři úrovně války, Spojené státy.

Table of Contents

Introduction

When The Terminator premiered in 1984, it became an instant success, making close to $79 million worldwide at the box office. The idea of a 'killer robot' traveling through time to complete its mission appealed to the general public, and played on a concept belonging to science fiction that had been its muse for years: artificial intelligence. Thirty-four years earlier, Isaac Asimov published his novel I, Robot, in which he introduced the concept of autonomous robots equipped with devices comparable to the human brain (Asimov 1950). The novel, and its main theme, became so popular that they influenced the understanding of 'robots' and their ability to think and behave similarly to humans for years to come. By coining the term 'robotics' in 1941, and later creating the Three Laws of Robotics as his most renowned work, Asimov's impact on the world was such that robots able to think like us are still present in the collective imaginary nowadays (Jung 2018). So much so that the general understanding of the topic best reflects the world of science fiction than the real one. The *file rouge* in this is the notion of artificial intelligence, of which Alan Turing is considered to be the father (Beavers 2013). Since Turing and Asimov's works dating back to the mid-twentieth century, artificial intelligence (here forth referred to as AI) and its application to machines have greatly progressed. AI can be found today in almost every aspect of society, from social media to self-driving cars. Its potential is such that even the military world has noticed it, and has proceeded to study possible applications of AI to the way in which wars are thought of and fought, with some practical examples already present on the battlefield.

As the study and progress of AI move forward, the potential military benefits linked to the use of this technology will inherently increase, opening the doors to a future of warfare that may

be much different from today's. The impact of AI on military affairs could even be understood as an actual revolution, as seen through the current discussions among theorists regarding the potential of an incoming Revolution in Military Affairs. However, the academic world is torn in regards to this last point, with ideas clashing regarding whether AI actually has the potential to drastically revolutionize the military world. In this thesis, we aim to attempt to set the record straight in this regard. For this reason, we will address the following research question: 'Is Artificial Intelligence the future Revolution in Military Affairs?'.

In order to do so, a thorough literature review is in order to best understand the current state of affairs regarding the topic at hand. This will allow us to develop a clear understanding of the matter, which in turn will be useful to assess the accuracy of the research question. To do so, both pieces supporting and criticizing the understanding of AI as a revolution in military affairs will be taken into consideration. The information extracted so far will be used in the methodological part of the project, looking at whether AI has the technological potential to be an RMA.

Further, the possibility of a different application of AI to military affairs based on countries' perception of the topic will be also taken into account. In order to do so, the concept of strategic culture as understood in the field of international relations will be of great use. Specifically, the United States and China will be taken as case studies, as they are both leading actors in the field of artificial intelligence and military affairs. A comparison between these two countries should allow us to assess possible differences in the implementation of AI in their respective military fields.

However, before being able to delve into the main part of this work, the key concepts of this project need to be thoroughly defined. Artificial intelligence, strategic culture, and revolution in military affairs will all be analyzed through an extensive historic and academic evaluation. The historic overview is fundamental, as the definitions of these notions are intrinsically connected to the history behind their creation. Alongside this, literature produced on these topics will be also analyzed, in order to reach a compelling and substantial definition for each one of the three concepts that can be applied throughout the process of addressing the research question.

The thesis will therefore proceed as follows: the key terms useful to this thesis will be defined, alongside the literature on said terms and on the idea of AI as a possible revolution in military affairs. Following this first part, an overview of why it is sensible to think about an upcoming revolution in military affairs and the research method on which this work is based will be introduced. The thesis will then move to its main chapter, looking into finding an answer to the research question. This will be followed by the application of the notion of strategic culture to the findings of the previous analysis, through which the possibility of providing a well-defined and applicable understanding of the topic at hand will be reached.

Conceptual and Theoretical Framework

Definition of Key Concepts

This chapter will focus on the definition of the three key concepts necessary for the success of the task at hand: artificial intelligence, strategi culture, and revolution in military affairs. This will be carried out alongside the analysis of noteworthy pieces of literature relating to said concepts as well as to the notion of AI possibly being a revolution in military affairs. Further, an attempt to prove why the current geopolitical situation could benefit from an upcoming revolution in military affairs will be made, followed by the explanation of the research method on which this work is based.

Artificial Intelligence and its application to Military Affairs

It is crucial, for the purpose of this project, to have a clear definition of artificial intelligence. The Turing test, also known as the imitation game, is a worthy starting point. This was proposed by the homonymous English mathematician in 1950 to establish whether a computer is able to think. The imitation game works as follows: "*One person, player C, plays the role of an interrogator who poses written questions to players A and B who are in a different room. Of A and B, one is human and the other is a computer*" (Johnson 2022). The objective of the interrogator is to correctly identify the computer from the human, in order to establish whether the computer can pass as a human. To do so, the interrogator can only ask questions and assess how human-like the answers given by players A and B are. The goal is for the computer to convince the interrogator of its humanity. This allows it to pass the test, having proved that it

can think like a human. Alan Turing introduced the imitation game with the following question: "*Can machines think?*" (Turing 1950). Hence, it could be argued that the first understanding of AI is of machines that can think similarly to men. However, this definition has the potential risk of conveying the idea that AI systems are machines that have the same intellectual characteristics as humans, which is oversimplistic and misleading. Furthermore, "*even if computers do think, the process might be fundamentally different from the human brain*" (Johnson 2022). For this reason, it appears sensible to look at more recent definitions as well.

To define AI, we will look at it through two specific concepts that are critical to its operation: machine learning and algorithms. The former represents a specific type of AI that has gained great popularity, the latter can be understood as those programs that allow AI to function. In 2018, Zuiderveen Borgesius offered a thorough overview of AI and other terms that are helpful to its understanding: machine learning (here forth referred to as ML) and algorithms. As far as AI is concerned, Zuiderveen Borgesius loosely defines it as the "*science of making machines smart*", adding that it "*concerns the study of the design of intelligent agents*" (Zuiderveen Borgesius 2018). In this case, the intelligent agent is a computer. The author then introduces ML, describing it as a specific type of AI that has been quite successful. Through ML, "*the knowledge in the system does not have to be provided by experts*" (Ibid.). As a matter of fact, said knowledge is found in sets of data that are provided to ML systems with the objective of offering examples of how to carry out specific tasks and identify patterns. By doing so, ML systems achieve the ability to make accurate predictions for "*data sets with huge numbers of parameters*" (Gammerman Vovk 2007). Machine learning, in its application, has reached such a level of success that it has become the norm for many to refer to AI when they are actually talking about ML, as if the two terms stand for the same concept, even though it is not the case (Zuiderveen Borgesius 2018). Lastly, Zuiderveen Borgesius looks at algorithms. According to

Dourish, an algorithm is "*an abstract, formalized description of a computational procedure*" (Dourish 2016). Algorithms can therefore be understood as computer programs that are able to take decisions, partly or fully autonomously depending on whether they need human assistance, which allow AI systems to function. Specifically, as far as ML systems are concerned, algorithms are the cogs in the machine that makes it possible to realize accurate predictions. It is crucial to point out how algorithms function by relying on information that has been previously supplied by human operators, which makes them subject to possible biases.

Dobrev sheds some more light in regards to the definition of AI, stating that "*AI will be such a program which in an arbitrary world will cope not worse than a human.*" (Dobrev 2004). According to Dobrev, AI can be defined as such when a program is able to adapt itself to the multifaceted reality of our world. Dobrev bases his new definition on the critique of Turing's definition of AI, disapproving of the latter for being 'non-formal' and because it "*does not separate the knowledge from the intellect*" (Ibid.). For these reasons, in the aforementioned definition Dobrev aims at providing an explanation of AI that is formal and that separates the knowledge from the intelligence, excluding the former altogether. In Dobrev's words, he defines "*something that knows nothing but which can learn*" (Ibid.). This is a key step in understanding AI: a program able to autonomously learn pieces of information and use them to carry out certain tasks, such as problem-solving, picture recognition, and language translation. We must now look into how AI "learns".

Borrowing from Zuiderveen Borgesius's analysis of Artificial Intelligence, it appears that it is through algorithms that AI systems, including ML, acquire the necessary information to carry out the operations they are tasked with (Zuiderveen Borgesius 2018). Specifically, it is through ML algorithms that AI systems acquire pieces of information and work with them, essentially

learning (V K 2022). Machine Learning algorithms are "*computer programs that can learn from data. They gather information* (…) *and use it to make themselves better at a given task*" (Ibid.). Creating ML algorithms usually begins with defining the problem that the system will have to take care of, including looking for ways to address this problem. Next, the data used to solve the problem is made readable for the ML algorithm itself. Further, the data will have to be pre-processed, to increase the accuracy of the final solution. Once all of these passages are accomplished, the algorithm is created, bearing in mind that "*the program must be structured in a way that it solves the problem, usually imitating human cognitive methods*" (Ibid.). There is an abundance of different types of algorithms that can be used in Machine Learning. Amongst these, a clear distinction can be made between supervised and unsupervised ML. These, in turn, can be divided into several categories, each of which has specific algorithms (Mahesh 2020). Supervised learning needs outside support and is optimal for a smaller and clear amount of data, whereas unsupervised learning requires no external assistance, there is no right or wrong answer, and "*algorithms are left to their own devises*" (Ibid.).

There are several applications of AI in today's society. Two examples known to most are the virtual assistants Siri and Alexa. The former, developed by Apple Inc, is a voice-activated personal assistant that makes use of ML technology to learn and improve its predictive capabilities regarding possible requests from its users (Adams 2017). Similar to Siri, Amazon's Alexa largely depends on AI and ML technologies to lower its error rates and improve its interface as well (Horowitz 2020). These technologies, despite their vast pool of users, are still far from being faultless. This is exemplified by an event that occurred in 2021, in which Amazon's Alexa suggested a child to touch a live plug with a penny. This recommendation was given as an answer to the child's externalization of her boredom. The issue is clear: such answer to this specific question should have not been amongst those possible alternatives

provided to the system, with an evident failure in vetting the possible dangerous repercussions (Shead 2021).

There are also examples that perhaps may be less obvious, such as the companies like John Paul. A luxury travel concierge, John Paul allows its clients to save time by tasking the company with the organizational aspects of their lives, such as booking flights, making reservations at restaurants, or planning events (Pham 2009). John Paul has been implementing the use of AI technologies, through predictive algorithms, to improve its understanding and predicting capabilities regarding its customers' needs. Its impressive predictive AI accuracy is corroborated by its placement amongst the 10 most popular AI technologies by Forbes in 2017 (Adams 2017). Finally, there is yet another case that has gained traction in recent years: self-driving cars. There are a plethora of companies focusing on this technology, such as the tech-moguls Microsoft and Apple Inc (Szymkowski 2021 ; Milmo 2021). However, it is perhaps Tesla, Inc that has popularized the most the very same concept of self-driving AI-enabled cars, since the release of the first version of its Autopilot system equipped on its Model S in 2014 (Lowensohn 2014). Still, it is worth noticing that, despite these technologies having progressed leaps and bounds, to this day the idea of a fully autonomous car driving in everyday traffic appears far away (Piper 2020 ; Domonoske 2021).

There are, however, possible applications of AI systems outside of the civil sphere as well. The military domain has been witnessing an ever-growing presence of AI-based equipment both on and off the battlefield (De Vynck 2021). De Vynck reports how "*cheaper access to computers that can crunch massive data sets in a short time has allowed researchers to make huge breakthroughs in designing computer programs that pull insights from large amounts of information*" (Ibid.), and how this has greatly influenced military performance as well. Recent examples are offered by lethal autonomous weapon systems (here forth referred to as LAWS).

Some examples are the South Korean SGR-A1 and the Israeli Harop 'Suicide Drone' and Sentry Tech system 'Roeh-Yoreh', based on the Samson Remote Controlled Weapon Station, (Shachtman 2007). The SGR-A1 has been guarding the demilitarized zone between North and South Korea since 2006, and can be described as "*a robot with the ability to autonomously identify and destroy targets*" (Velez-Green 2015). When operating in its unsupervised mode, it is able to autonomously identify, track, and eventually fire at intruders without the intervention of a human operator, acting solely based on its AI apparatuses (Gronlund 2019). Similarly, Israeli Harops are also able to autonomously attack targets "*meeting previously identified criteria*" (Bensaid 2021). However, the application of AI to the military sphere goes well beyond unmanned weapon systems, and plays a key role outside of the battlefield as well, as previously stated. A research paper titled "Advanced military technology in Russia" provides compelling evidence of how vast the use of AI for military purposes can be (Bendett et al., 2021). When it comes to Russia, it appears that its "*approach to military AI prioritizes technologies and capabilities that can be used to debilitate the adversary's command, control and communications systems, as well as gain information superiority*" (Ibid.). Hence, the focus appears to be not so much on unmanned weapon systems, which are still being developed and engaged, but more on "*intelligence, surveillance, and reconnaissance (ISR) capabilities, EW, cyber warfare, information operations,* [without disregarding] *ground-based fires*" (Ibid.). For instance, electronic and cyber warfare are both strategic areas that appear to have a great potential for the application of AI systems, and the recent Russian behavior towards them appears to confirm this feeling. At the time the paper was published, Russia was known to have a considerable amount of mobile electronic warfare systems, of which at least one with AI capabilities: the RB-109 A Blyna system EW (Sukhankin 2017 ; Petrella, Miller Cooper 2021). This system is capable of autonomously targeting objectives such as radio and communication systems, satellites, and other strategic apparatuses, independently choosing the best course of

action to make them inoperative through the use of AI (Bendett, Boulègue, Connolly, Konaev, Podvig Zysk 2021). Concurrently, cyberattacks have also witnessed increased automation through AI systems. The differences between the 2015 and 2016 Russian cyberattacks against Ukrainian power grids prove it. Whereas in 2015 it was carried out mainly through human inputs, in 2016 the attack reached such a level of automation that, through the malicious code CRASHOVERRIDE, it was possible to "*automatically find circuit breaker controls and toggle them on and off, creating a blackout*" (Buchanan, et al. 2020).

The use of AI technologies in information wars is vast and touches on a plethora of different fields. As such, AI has been utilized to blur the lines between real and fake, most relevantly exemplified by deepfakes. Westerlund defines deepfakes as "*hyper-realistic videos that apply artificial intelligence (AI) to depict someone say and do things that never happened.*" (Westerlund 2019). A recent utilization of deepfakes can be found in the ongoing conflict in Ukraine. Indeed, a deepfake tied to Russian disinformation efforts circulated portraying Ukraine President Zelenskyy telling his soldiers to lay down their arms and surrender to Moscow's troops (Allyn 2022). The potential damage such videos carry is rather straightforward: sowing confusion and disarray in the opposing camp. It is clear that, in the aforementioned case, the objective was to shatter Ukrainian civilians and troops' morale in order to weaken their efforts in resisting the Russian invasion. Paired with the vast reach allowed by social media, deepfakes have the potential to negatively impact millions of people around the world. In wartime, the possibility of influencing millions of the enemy's citizens with fake and distorted information regarding the advancement of military operations presents a threat too great to be ignored. Deepfakes reflect the speed at which technological advancement is progressing in the field of artificial intelligence. Quoting Hao Li, a forerunner of deepfakes, O'Neill reported that "*AI-powered deepfake video technology is advancing faster than even some of the world's top experts thought possible*" (O'Neill 2019). So much so that

Li himself, when interviewed on the topic in 2019, stated that perfectly real deepfakes were just around the corner and, with them, the possibility of telling them apart from legitimate videos would disappear (Stankiewicz 2019).

Russian examples are exhaustive and provide a clear view of how vast the application of AI to the military world can be. Yet, Russia is not alone in this. Both the United States and China have been developing AI systems to incorporate into their respective fields of Military Artificial Intelligence (Morgan et al. 2020). These cases will be addressed in-depth in the next chapters.

The history of Strategic Culture and its current place in the field of International Relations

The concept of strategic culture has gained great popularity amongst academics in the field of international relations to explain why different countries implement different strategies in the international arena. However, despite its wide use, there appears to be a general confusion when it comes to defining what strategic culture is and how this concept should be used (Lock 2017). In international security studies, the focus on culture is quite recent. In 1995, Johnston wrote that "*the question of culture did not attract much attention in international security studies and international relations theory until the last ten to fifteen years, when interest in culture, strategic culture, and other ideational explanations for the behavior of states has grown*" (Johnston 1995). The main reason why is found by Johnston in the fact that the analysis of the field of strategic studies has been significantly influenced by "*American ethnocentrism and a concomitant neglect of national styles of strategy*" (Ibid. ; Nye Lynn-Jones 1988). However, this idea that culture influences the way in which war is waged and strategies are

developed finds its roots much earlier in history. Thucydides and Sun Tzu stand out as classical authors whose works inspired the conception of strategic culture and remained relevant to this day (Lantis 2006). In this regard, Lantis refers to the work of Clausewitz, in which the Prussian general and military theorist highlights how the goal of military strategy was not solely to defeat the enemy: it was to deprive morale from the enemy as to defeat it on all fronts (Ibid. ; Clausewitz, et al. 1984). Farrell provides an insightful analysis of culture and military power, in which he looks into how military power is created by states and the role of culture in this process (Farrell 1998). Specifically, he highlights the key role that cultural norms play in the organizational choice of a country regarding its military institution. To prove this point, he takes from Kier's "Imagining War: French and British Military Doctrine between the Wars" (Ibid. ; Kier 1997). According to Farrell, in her book Kier "*argues that culture shapes behavior by providing the means of action, not the ultimate ends*" (Farrell 1998). She exemplifies this through her discussion of the French Army's switch from an offensive to a defensive posture in 1928. The reason for this change is to be found, according to Kier, in the institution of short-term conscription in France. The French Army made this change not based on a preference, but because it did not consider conscripts capable of carrying out offensive operations, hence the need to move to a defensive position. Miller provides another argument in favor of culture being instrumental in countries' military strategies in the example of Israel (Miller 2014). The author associates Israel's predilection for short-war strategies with cultural features of the country. Specifically, he refers to "*Israel's lack of geographic depth, small but educated population, and technological skill*" (Ibid.), together with the setting of the Cold War in which diplomatic intervention from other countries could have caused a war to end before any gain had been obtained by Israel, as factors that shaped the country's military strategy.

As exemplified through the previous cases, it is clear how culture has effectively been playing a key role in how armies and nations develop their strategies. To have a clearer view of how

this happens and to what extent, an analysis of the literature concerning the concept of strategic culture appears necessary. Beginning in the last two decades of the 20th century, three separate generations of academics have focused on the notion of strategic culture.

First appeared in the early 1980s, the first generation focused mainly on why Americans and Soviets thought differently in regards to their nuclear strategy. For the first time, culture was no longer relinquished to a secondary position in the study of military strategies. Specifically, the first generation identified culture as a key element in describing differences in nuclear strategies (Uz Zaman 2009). Colin S. Gray has been a significant contributor of the first generation, describing the U.S.' strategic culture and how this had a direct effect on its nuclear strategy as well (Ibid.). According to Gray, American strategic culture is influenced by American historical experience, which is unique on many levels. Without going too much in detail, its history has led the United States to develop a nuclear strategy with the following characteristics. First, the belief that superpowers shared a common view on a desirable status quo in the world led to relying on strategic stability. Second, rationality and reason both played crucial roles in the aforementioned strategy. As the idea of waging a nuclear war appeared irrational, as the doctrine of mutually assured destruction (MAD) made it so that the use of nuclear weapons would have meant total annihilation of the attacker and the defender, the possibility for such an event to happen was considered unreasonable. For this reason, strategies aimed at the safeguarding of the American people at a time of nuclear incertitude relied merely on "*anticipated pre- or intra-war deterrent effect*" (Gray 1981).

The first generation soon faced criticisms from the academic world. Notwithstanding the innovative take they brought to the study of international relations, first-generation work presented several issues. First of all, it was affected by a definitional problem. As too many variables were deemed to influence countries' strategic culture, the definition appeared too

vague and unwieldy. Furthermore, their theory seemed to lead to the simplicist view that there was, and only could be, one strategic culture for each country (e.g. one American and one Soviet strategic culture), a vision characterized by a "*narrow determinism*" (Johnston 1995).

As the literature produced until then on that topic appeared unsatisfactory, the focus on strategic culture shifted consequently to the hands of second-generation scholars in the mid-80s of the 20th century. One of the most influential authors of this camp is Bradley S. Klein. According to him, "*strategic culture emerges from a web of international practices (...) that implicates the country abroad and that constrains the range of activities comprising the political economy of domestic society. These constraints establish the range within which decision-makers arrive at policies through debates in the foreign policy bureaucracy. And these constraints are interpreted (...) as comprising the 'realities' (...) of international relations*" (Klein 1988). Strategic culture, therefore, is described as the result of countries' international behaviors and customs that define the limits between which those countries can act. A further crucial element identified by the second generation is that of 'hegemony', which allows for a noteworthy distinction between strategic culture and strategic choice. Strategic culture is still understood as the outcome of the historical experiences of every country. However, Klein notices, there is an impressive gap between the strategic culture of a country and the actual behavior of said country. The reason lies in how the behavior of a country is affected by its citizens: elites and ruling classes, the hegemonic groups, can affect said behavior based on their interests (Ibid.). Much like its predecessor, this generation was not free from criticism. Specifically, critics have pointed out the unclear relationship between the strategic culture (the symbolic discourse) and behavior (Johnston 1995). It does not appear evident, from the provided literature of the second generation, whether strategic culture can actually condition behavior.

In the 1990s, a new generation took over the task of studying the concept of strategic culture with the ambition of straying away from what it saw as issues related to how previous scholars approached the subject. This new generation immediately positioned itself as more methodologically rigorous than the previous ones (V 2020). According to Johnston, one of its most eminent representatives, the third generation overcomes the flaws of the previous ones. For instance, it differentiates itself from the first because it renounces that element of determinism that characterized it. Furthermore, this generation aims at reaching more accurate findings through competitive theory testing (Johnston 1995). Another crucial difference is the exclusion of behavior as a component constituting strategic culture. By differentiating strategic culture from behavior, strategic culture becomes the independent variable (alongside its components), whereas strategic behavior becomes the dependent variable (V 2020). Much like in the past, this literature was the object of criticism as well. Specifically, they did so apropos Johnston's study of the Chinese strategic culture and its link to the use of military force vis-à-vis outer menaces. Critics have mainly focused on his failure in making his study methodologically rigorous, adding that the conclusions of his investigation would suggest the presence of two, and not one, Chinese strategic cultures (Uz Zaman 2009).

It now appears that a fourth-generation has taken the stage of international relations when it comes to strategic culture (Echevarria 2013). Initially appearing around the beginning of the 2010s, this new generation sees in Alan Bloomfield one of its main theorists. In its critique of the previous generations, Bloomfield notices how previous scholars have failed in agreeing almost on anything relating to the concept of strategic culture, hence making the understanding of strategic culture a problematical task. For this reason, there appears to be the need for a reconceptualization of the debate over strategic culture (Bloomfield 2012). In his work, Bloomfield reaches the conclusion that the possible existence of various strategic cultures

within one country needs to be taken into account. Scholars of the fourth generation suggest the presence of strategic subcultures pitting against one another in order to influence decision-makers. Only the strategic subculture able to provide an appropriate answer to the tactical challenges present at the moment will be picked as dominant (Ibid.). The fourth-generation brings to the discussion regarding strategic culture an innovative take, that of strategic subcultures, which represents a break from the previous scholars. However, at the same time, this theory allows to find a middle ground between the first and third generations. Specifically, this new take on strategic culture takes from first-generation's scholars, chief among which Gray, the idea that culture offers context. More precisely, "*it guides and shapes interpretation: we just have to accept that culture is a disaggregated thing with contradictory elements rather than a monolithic whole*" (Ibid.). Concerning Johnston, and consequently the third generation, it shares with them the goal of building falsifiable theory. This makes it possible to understand whether a different subculture may take over the dominant one when important changes in a country's strategic environment or identity occur because one specific subculture fits better the newly established environment.

The ever-evolving discussion regarding the concept of strategic culture, and the many points of contrast that have appeared throughout its history between its scholars make achieving a generally agreed-on definition of said concept a strenuous task. Even when points in common are found, respective conclusions of each generation always appear to differ on noteworthy elements. However useful for a complete understanding of the key elements that have shaped the concept of strategic culture and, consequently, its understanding and application, the evolution of its related literature does not offer the answer to those looking for a clear definition. For this reason, Longhurst's definition of strategic culture will be offered as a general explanation of the concept, bearing in mind the key elements that have been the subject

of discussion in the previous paragraphs. According to Longhurst, strategic culture can be better understood as "*a distinctive body of beliefs, attitudes and practices regarding the use of force, held by a collective and arising gradually over time through a unique protracted historical process. A strategic culture is persistent over time, tending to outlast the era of its inception, although it is not a permanent or static feature. It is shaped and influenced by formative periods and can alter, either fundamentally or piecemeal, at critical junctures in that collective's experiences*" (Longhurst 2018).

In this section, we have highlighted the vast process behind the conceptualization of strategic culture, which has made it possible to pick a definition of the concept that appears to include the most salient features analyzed by the aforementioned four generations. However, it is worth highlighting three specific features that were met in the historical overview: the understanding that strategic behavior depends on strategic culture, as stated by the third-generation, and the idea of several subcultures in one country and the possibility of shifts between them as the dominant one, as stipulated by the fourth generation. Their understanding is crucial, as these will be instrumentalized later on both in regards to the analysis of the research question as well as in the comparison between the implementation of AI by the United States and China.

Defining the concept of Revolution in Military Affairs: how to accurately identify one.

The way through which the term Revolution in Military Affairs (here forth referred to as RMA) came to be is noteworthy. Almost a decade before the concept of RMA as it is understood today was coined, Soviet theorists had produced a significant body of work regarding the idea of a Military-Technical Revolution (here forth referred to as MTR). The idea of military revolutions took shape through several papers produced in the Soviet Union around the 1970s and '80s,

with Marshal N.V. Ogarkov creating much of the literature concerning the topic (Metz Kievit 1995). MTR was the initial idea that allowed U.S. defense theorists to come up with the theorization of RMA. The gap of almost a decade between the Soviet studies on MTRs and the adoption of the term RMA by American theorists can be explained through the struggle faced by the Soviet Union to bridge MTR conceptualizations and the actual capabilities of its forces. It was the United States that first used the term RMA and laid the groundwork for its development. Andrew Marshall, the first director of the Office of Net Assessment, defined RMA as a "*major change in the nature of warfare brought about by the innovative application of new technologies which, combined with dramatic changes in military doctrine and operational and organisation concepts, fundamentally alters the character and conduct of militar operations*" (Maloney Robertson 1999). Specifically, in the years between 1950 and 1969, Marshall's work focused on intercontinental nuclear warfare, which later proved key to his understanding of RMA. American strategy vis a vis nuclear interactions with the Soviet Union was strongly influenced by the concept of deterrence. This concept was well present in the minds of the enemy as well, hence understanding specifically how it was seen by them was crucial to develop a reliable deterrent strategy. Furthermore, in doing so, he realized that the American attempts to think like the leaders of the Soviet Union were deeply problematic, as key-cultural features that shaped the way in which Soviets thought were not taken into consideration by the Americans, causing them to reach very different conclusions from those reached by their Soviet counterparts (Rosen 2010).

An RMA can be understood as a radical change in military innovation. Technological progress has typically largely played a key role in these revolutions. However, technological advance itself is not enough: it is how people react to these advances and implement them in the civilian and military sphere that determine whether a revolution in military affairs will or will not occur.

Furthermore, by definition an RMA requires changes of such magnitude that they impact almost every sphere of the military and political environment, from the structure of armies to countries' power position, digressing all the way to the civilian sphere as well (Cohen 1996). With this said, it is clear why this phenomenon is defined through the idea of a revolution. As this is the case, in its being revolutionary, it appears safe to stipulate that an RMA, in order to be considered as such, must affect all of the three levels in which war can be divided. These are the strategic, the operational, and the tactical level, of which Sukman offers an in-depth analysis (Sukman 2016). Despite the author's objective is to criticize them, as he believes that they are not representative enough and that they miss a fourth institutional level, his descriptions are still useful to understand what they represent. First of all, it is worth noticing that there is a hierarchy amongst these terms, with strategic ranking the highest, followed by operational, and tactical. At the tactical level of war, we find battles and military engagements, carried out by on-the-ground troops trying to accomplish military aims (Ibid.). One step higher, the operational level witnesses the planning and execution of military operations and campaigns (Romaniuk 2017). Finally, at the top of the pyramid, the strategic level is where "*a nation* (…) *determines national or multinational* (…) *strategic security objectives and guidance, then develop and uses national resources to achieve those objectives*" (Sukman 2016). For its defining characteristic of being revolutionary, an RMA will have to cause remarkable changes in specific fields that can fall within the categorization of the three levels of war (Neuneck 2008). For this reason, as the purpose of this project is to look whether AI can be identified as the incoming RMA, by also focusing on the cases of China and the U.S.A., a possible AI-RMA will be analyzed through this understanding of warfare as well.

Changes at the tactical level may appear to be the easiest ones to understand, as they are also the most noticeable and indicative. As a matter of fact, if the way in which war is waged on the battlefield was to change, these effects would be easy to spot. At the same time, if as a

consequence of an alleged RMA nothing was to change on the battlefield, it would be safe to assume that the consequences cannot be considered revolutionary. As far as the operational and the tactical levels are concerned, here the changes may be less visible to non-experts, however this does not make them any less crucial. Regarding the former, it appears sensible to see it as linked to the tactical level. If the way in which war is carried out at the heart of the conflict changes drastically, this has to be a consequence of a radical revolution in how military operations are planned and executed at the operational level. Similarly, if the operational level is strongly revolutionized, this will reflect on the tactical one (Luttwak 1980). Finally, looking at strategy, revolutionary changes in military affairs would have potential effects on the international equilibrium between nations, as these changes would carry along alterations in national policies in regard to wars and conflicts. These could go as far as causing shifts between alliances, changing the status quo of the international arena. As, according to Cohen as previously stated, the magnitude of an RMA needs to affect even the highest sphere of countries' international power positions, the strategic level being affected appears to be a crucial element in correctly identifying an RMA.

For the fairness of the project, it seems appropriate to highlight how there are authors that have cast doubts regarding the partition of warfare into three levels. It appears that the issues do not relate to the single levels per se, but more to their limits in describing warfare without the addition of a fourth. For instance, as previously stated, Sukman complains about the absence of a fourth level, which he identifies as the institutional level (Sukman 2016). At the same time, Bateman states in his work that the fourth level that needs to be taken into consideration is the political level (Bateman 2015). This thesis is not the appropriate place where to discuss whether these criticisms are well-founded or not, nor to establish whether additional levels are necessary. We will keep our focus on the three levels that have been introduced, as they alone seem to be generally agreed on by the academic community.

In order to reach a satisfying definition necessary for this work to clearly state whether the impact of artificial intelligence on military affairs can be described as an RMA, an overview of the academic debate behind the defining features of this concept is in order.

Two of the most renowned authors in this field are Alvin and Heidi Toffler. They looked at how, in their understanding, the term 'revolution' was applied too generically to events that actually represented 'sub-revolution'. Examples of such are the invention of gunpowder and submarines for instance. To truly represent a revolution, the authors stated the event taken into consideration needs to "*change the game itself*" (Sloan 2009). To be qualified as such, a true RMA needs not only to include technological changes, but also doctrinal and organizational developments. According to this view, only two RMAs have occurred throughout history, reflecting the two distinct ways men and women have developed to make wealth. The first wave corresponded to premodern societies, in which the majority of the population made their living through manual work, specifically concerning agriculture. Hence, wars were mainly fought over the control of agriculture and carried out through hand-to-hand combat. The second revolution in the way peoples made their living, with its corresponding RMA, concerns the industrial revolution and its mass production. For the first time, mass destruction enters warfare, with the ideas of *levée en masse*[1] and the birth of the machine gun as a product of the machine age (Ibid.).

Based on this understanding of RMA, at the time the Tofflers were presenting their theories a third RMA was developing, the IT-RMA of the 1970s-80s previously mentioned. This period was characterized by the demassification of mass production, with specialized and skilled individuals taking over low-skilled and interchangeable workers. At the same time, small and

[1] "*The concept originated during the French Revolution, and was internationalized with its inclusion in the rules of armed conflict adopted by the Union Army during the American Civil War. Levée en masse continued to be included in the major international law of armed conflict documents from that time on, including The Hague Regulations of 1907 and the Geneva Conventions of 1949.*" (Crawford 2011).

differentiated work teams had replaced large and bureaucratic companies. The 1990-1991 Gulf War was the first example of third-wave weapons being used on the battlefield on the part of the U.S.-led coalition against second-wave weapons used by Iraq, with the authors citing specifically Operation Desert Storm (Toffler Toffler 1994).

Although the Tofflers are universally recognized as essential theorists in the RMA field, they are not the only ones that have offered worthwhile definitions of this concept.

For instance, Andrew Krepinevich also offered a definition of RMA. According to his theory, which comes to a different conclusion from that of Alvin and Heidi Toffler, there have been ten military revolutions since the 14th century. According to the author, an RMA is "*what occurs when the application of new technologies into a significant number of military systems combines with innovative operational concepts and organizational adaptation in a way that fundamentally alters the character and conduct of conflict. It does so by producing a dramatic increase - often an order of magnitude or greater - in the combat potential and military effectiveness of armed forces*" (Krepinevich 1994). It could be argued that Krepinevich falls in what Mr and Mrs Toffler criticized as applying the definition of a 'revolution' too generically, with phenomena such as the invention of fortresses falling in Krepinevich's definition.

An author whose work is similar to that of Alvin and Heidi Toffler, on the other hand, is Williamson Murray. It is worth noticing how he differentiates between military revolutions and revolutions in military affairs. In "Thinking About Revolutions in Military Affair", Murray states that "*there appear to be two distinct historical phenomena involved in radical innovation and change. The first can be called military revolutions* [while the second can be called] *RMA*" (Murray 1997). This distinction is crucial: for RMAs to happen, they need to follow the previous larger phenomenon of military revolutions. There appear to have been four military

revolutions, with two happening at the same time, which have "*fundamentally changed the nature of warfare in the West*" (Ibid.). These are the creation of the modern nation-state in the 17th century, the French Revolution and the industrial revolution concomitantly, and World War I. Murray's twofold understanding of the concept at hand allows us to introduce a further theorist: Clifford Rogers. Much like Murray, Rogers makes a distinction between military revolutions and revolutions in military affairs. Noticeably, however, Rogers identifies the phenomenon of RMA as preceding that of military revolution (Sloan 2009). Only after an RMA has appeared, therefore, can it be said that a military revolution will follow. More specifically, military revolutions take place when "*an RMA has wide-ranging implications for social, economic, and political structures, balances of power, and other areas outside the realm of the armed forces*" (Ibid.).

There is an academic consensus in regards to the last recognized RMA being the Information-Technology Revolution in Military Affairs (here forth referred to as IT-RMA) (Adamsky 2010). The IT-RMA is of particular interest for several reasons, chief amongst which is its history and how it came to be, with the United States, the Soviet Union, and Israel playing a crucial role in this process. It is worth noticing that each country has approached this RMA in quite a different way than the others: while both the United States and Israel have proceeded by first developing the technological and only after the theoretical seeds of this RMA, for the Soviet union it was the opposite (Adamsky Bjerga 2010). Drawing a parallel with the evolution of the term RMA, the Soviets were the first to theorize about the IT-RMA and its long-term consequences. However, it was the United States that developed technology and weaponry that were the products of the IT-RMA for the first time, without noticing their revolutionary potential. Despite this, it is the Israeli Defense Force (here forth referred to as IDF) that would, for the first time, employ the newly produced systems that were the creation of the IT-RMA

on the battlefield. Despite being the first country to implement these new RMA-inspired weapons, Israel was the last country amongst the three to develop the conceptual aspect of the IT-RMA (Adamsky 2010). Adamsky and Bjerga offer a stimulating and useful idea as to why the idea of RMA has developed so differently amongst these countries, although getting to the same conclusion. According to these authors, "*cultural, ideational, institutional and personal factors significantly conditioned develop- ment of modern military theory.*" (Adamsky Bjerga 2010). This is of particular interest to this project, as it highlights the crucial role that culture and other elements that constitute strategic culture play in how specific RMAs develop in different countries, as will be better seen further on in the thesis.

According to Adamsky, the IT-RMA has brought along significant changes in regards to basic capabilities and both mechanical and organizational terms. In regards to the basic capabilities, the IT-RMA provided greater accuracy regarding striking capabilities together with stealth and unmanned technology to drastically reduce the risks of piercing through enemy lines. Perhaps most importantly, however, it provided the revolutionary technology to move information rapidly. This is paired with mechanical innovations such as PGMs[2], C4I[3], and RSTA[4]. Lastly, looking at the organization, networks and communications are now more important than they used to, with the number of troops and their advancement having lost some of their significance (Adamsky 2010). Chapman offers the war in Vietnam as an example of the application of IT-RMA. Specifically, he finds in that conflict the debut of PGMs (Chapman 2003). Laser-guided precision guided munitions deployed by four Phantom F-4 fighters bombers were used to destroy the Thanh Hoa bridge, which had resisted unharmed a previous bombing attempt carried out through more conventional airplanes (Ibid.).

[2] Precision guided munition.
[3] Command, control, communications, computer, intelligence.
[4] Reconnaissance, surveillance, targeting acquisition.

In addition to providing a practical example of an otherwise theoretical understanding of the concept of RMA, the introduction of the IT-RMA will be later instrumental as it will be compared to the potential AI-RMA in order to assess whether the latter is to be considered simply as an evolution of the former or whether it can be considered as a new phenomenon.

Literature review concerning Artificial Intelligence as a possible Revolution in Military Affairs

The potential that emerging technologies could have on military affairs has always been clear to the experts of this field, with improvements coming from computer science being no exception. For example, in 1958 the United States Department of Defense (here forth referred to as DoD) established the Advanced Research Projects Agency (today known as DARPA), in response to the Soviet launch of the Earth satellite Sputnik 1 (Van Atta, Deitchman Reed 1991).With the main focus of this agency being developing new technologies in order to use them in the military, DARPA has supported the development of the internet and of artificial intelligence as well (Waldrop 2012). As this trend dates back to the last century, a vast amount of literature has been produced on the topic. Not only on the impact that AI can and has on military affairs, but also more specifically on whether AI represents an RMA. For the purpose of this thesis, it is beneficial to briefly cover recent findings on the concepts of AI and RMA, which can be of use in supporting the goal of this work.

First, it is important to highlight the polarizing nature of this subject. Not only in regards to the pros and cons of a possible AI-RMA, but in regards to whether AI can be considered as an RMA altogether. Whereas a part of the academics interested in said field is more inclined to

agree with this, others oppose this view and state that the improvements introduced by artificial intelligence are not to be considered revolutionary. Stefanick falls in the latter category: notwithstanding the critical support that AI can supply to specific military purposes, the author disagrees that this can be considered as revolutionary as it is the case for social media and AI-enabled computer games (Stefanick 2020). In his analysis, which takes into account the case of the United States, the author states that the availability of the information necessary for AI/ML systems to operate is drastically different between the military and civil spheres. Whereas when it comes to social media, for instance, millions of users every day provide detailed pieces of information that are gathered and fed into specific algorithms that allow for extremely accurate AI systems to function, the same does not happen in the military case. In the latter, information is not easily accessible, as it needs to be acquired against the will of the opposing actor. Furthermore, it oftentimes happens that, because of how it is obtained, this information is incomplete or deceiving. As a consequence, if the information provided to algorithms is inaccurate, AI/ML systems cannot be expected to run properly, greatly reducing their contribution to the military world (Ibid.). As there appears to be only a handful of situations in which AI can offer groundbreaking support to military operations, today's circumstances are not much different from a time before AI, with human operators still being crucial. For these reasons, Stefanick does not see an element of revolution in AI, more so a technology that is set to provide some improvements throughout a long and slow evolution (Ibid.).

Raska addressed this subject by looking at the revolutionary potential that applying AI to the military sphere could bring to it and whether this is enough to describe AI as an RMA (Raska 2020). The author recognizes that artificial intelligence has a potentially revolutionizing role in both the way the military world works and in how countries interact through their military

postures. As far as the former is concerned, Raska sees in AI an instrument capable of putting into question the very same idea of human involvement in future warfare. Further, this innovation is no longer driven by the military-industrial sectors of their respective countries. On the contrary, it is the commercial sector that is developing new technologies that lend themselves to military uses as well, with private firms assuming the role of strong actors in this scene (Ibid.). The way in which this new AI-produced wave is proceeding is, according to Raska, different from any RMA of the past, as it touches upon several scenarios simultaneously. From changes in the international strategic competition to the possibility of smaller powers to aspire to question their military dependence on greater powers, the world of international relations is witnessing something of a revolution. Alongside all of these characteristics, the ideas of a future in which wars will be increasingly unmanned, and in which machines are destined to gain more importance in their relation with humans, make the application of AI to the military sphere nothing short of revolutionary (Ibid.). For all these reasons, the author concludes that what could be defined as an AI-RMA represents an actual breaking point in how warfare is thought of and carried out.

There is a final concept that can be extracted from Raska's article that is of great use to this work. In his analysis, the author finds that the AI-RMA is inherently linked to the "*growing US-China systemic rivalry and their varying 'techno-nationalist' visions*" (Raska 2020). For the first time in modern history, the United States is faced with a competitor in the development of military technologies that could be responsible for a revolution in military affairs. China is a country that has proved more than capable to pursue its own AI-RMA, developing it in such a way to pose a serious threat to the U.S. geopolitical international stance. As a matter of fact, despite them not being the only two, the United States and China are the main players when it comes to AI-RMA (Ibid.). As a consequence, it does not come as a surprise that much of the

literature on the possibility of an AI-RMA focuses on either one of the two countries, highlighting different strategies implemented depending on the country. For example, Ijebor addresses the idea of an AI-RMA by focusing mainly on the case study of the United States (Ijebor 2020). He finds that AI has potential revolutionary applications to military affairs, but at its current state it is too early to define it as a fully-developed RMA (ibid.). Similarly, Kania addresses this topic by focusing specifically on China (Kania 2021). What is of great interest to this project in her analysis is the fact that she highlights an important difference in how China is approaching AI in its military affairs vis a vis the United States. The author credits this distinction to the diverging strategic cultures of the two countries, which influence their respective take on how to best implement these technologies (Ibid.). It appears, therefore, that respective differences in Washington and Beijing's strategic cultures are key to AI-RMA.

This should not come as a surprise, as countries' culture has for long been recognized as an impacting force on their behavior, as previously analyzed as well. As a matter of fact, there appears to be an inherent relation between the concept of strategic culture and the history of RMA as well. The way through which the very same idea of RMA came to be is strongly linked to diverging cultures around the world. More specifically, as previously seen, American theorists first started seriously looking into how different cultures could influence military and strategic behaviors in relation to their own and the Soviet nuclear posture during the Cold War. Marshall's own definition of RMA was rooted in his work on intercontinental nuclear warfare and the cultural differences at the base of the respective diverging stance on nuclear warheads of the U.S. and the USSR. However, we stipulate that whereas in the case of previous RMAs strategic culture played a role in how emerging technologies and their use were understood and employed (e.g. nuclear weapons), its effects in the case of AI are different. When it comes to this technology, strategic culture influences the way these emerging technologies are

approached, making it so that different countries develop very different systems based on the same technological advance.

The necessity of a new RMA in today's geopolitical reality

This paper argues we are on the brink of a new RMA, yet for this point to be convincing it is essential to discuss how the current context lends itself particularly well to the development of a new RMA. Prior to the IT-RMA, the nuclear RMA has brought with it lasting changes which impact on society reverberates strongly to this day. Since their advent, nuclear weapons have drastically influenced the possibilities of international actors to wage wars or to take part in ongoing conflicts without the risk of causing a nuclear war. This risk, naturally, grows exponentially when nuclear powers are directly involved in a conflict (Sirota 2022). As this situation first came to be during the Cold War, when only the United States and the Soviet Union were nuclear powers, the doctrines of mutually assured destruction and nuclear deterrence proved to be efficient in preventing a full-scale nuclear war. As of this day, nine countries have developed a nuclear armament, and the situation has consequently drastically changed (Kristensen Norris 2013). The current repercussions caused by the nuclear RMA plunge countries into an unsustainable existential dread reminiscent of the Cold War. Specifically, the threat of the use of nuclear weapons prevents international countries to intervene when it appears that a nuclear power is grossly violating international laws. To prove this point, the conflict that is currently raging between Russia and Ukraine proves to be of particular use. As the war drags on, with millions of refugees and thousands of deaths, the world stands still, paralyzed by the fear of the use of nuclear weapons by the aggressing country. Apart from alternative tools to war, such as diplomatic and economic sanctions against Russia or the supplying of military equipment to Ukraine, countries seem to be unable to offer

the military support Ukraine has been asking for. To further cement this point, the role that the European Union, NATO, and the United States are playing in this crisis is representative of the idea of a nuclear stalemate. These actors have openly sided with Ukraine, but despite having the military capabilities of forcing Russia away from its current course, they are avoiding to military engage against Moscow fearing nuclear repercussions (Harb 2022 ; Guyer 2022).

Wolfson and Dalnoki-Veress paint a terrifying picture of the effects that a nuclear war could have. They stipulate not only that the immediate effects of nuclear weapons going off would be devastating in terms of loss of lives and infrastructures, the nuclear fallout contamination caused by the blasts may persist for years to come (Wolfson Dalnoki-Veress 2022). Further, a confrontation between nuclear powers, with an estimated deflagration of a few thousand weapons, would have extremely severe effects on the environment of the planet and would represent a catastrophe for humanity (Toon, Robock Turco 2008).

As we seem to be entering a phase of nuclear deterrence in which powers are willing to make more or less veiled threats regarding the use of their nuclear arsenal, we stipulate countries need a new technology to base warfare around. As it stands, the risks linked to possible repercussions of an AI-RMA seem unlikely to compare to those of nuclear warfare. It must be noticed that new RMAs do not automatically replace those that came before. However, they could change the world of military affairs drastically enough to render previous RMAs outdated. This could be an incentive to shift the focus far away from nuclear military strategies.

Research Method

Having presented and described the key concepts of this project, we will now move to discuss the methodology behind this work.

First, through secondary document analysis, we will look at whether artificial intelligence fits the mold of an RMA or not. The use of document analysis lends itself well to this task, as it allows to compare specific features of both AI and RMA based on academic and journalist work produced by the very same theorists that coined these concepts or that have contributed to their understanding. In doing so, the reliability and accuracy of the data taken into account are guaranteed to be as consistent as possible. Further, this also facilitates the scope of the project. Instead of attempting to establish the validity of the research question through the collection of primary and experimental data, secondary document analysis makes for a more precise research tool. The documents used to carry out this task are both those previously used to establish the main features of AI and RMA, alongside new literature focusing on the analysis of AI as a possible RMA. The information gathered through this process will be then applied to both concepts, in a comparative attempt to establish whether the two have similarities strong enough to assess AI as an RMA. This process will be twofold: in the first place, the conceptualization of the three levels of war previously introduced will be instrumentalized to see if the main characteristics of AI allow for radical effects on all of the three levels. As we have stipulated, to be considered as such an RMA needs to revolutionize all of these levels of war.

It was previously noticed that different cultural factors linked to specific countries can influence how these countries approach RMAs. In the specific case of a possible AI-RMA, we argue that the effects would be felt stronger than in other cases, leading to the implementation

of different approaches. Hence, for a correct understanding of the concept of AI-RMA it is crucial to consider the cultural setting that is allowing its development. For this reason, alongside the aforementioned points, the concept of strategic culture will be taken into consideration in order to observe similarities and differences in how international actors are implementing AI in such a way that it can be considered an RMA. In looking at strategic culture, a comparative method between a pool of significant countries appears to be the most useful approach. Specifically, a comparison between the United States and China can show important differences that are useful to the thesis. The task will be carried out through a comparative analysis of the two countries. This method has been chosen as it is particularly suitable for the objective of this section. This process is crucial for the success of the predictive part this thesis wishes to accomplish. The results will be based on the study of already existing differences between the USA and China regarding the implementation of AI in their military affairs. Furthermore, the study of these elements, alongside that of how strategic culture has influenced them, will allow to make solid predictions on future developments. As in the first part of this chapter, secondary document analysis will be the methodology of choice as well. The reasoning is similar to the aforementioned explanation, with the addition that information regarding the current application of AI to countries' military affairs may be inaccessible to someone who is not part of the field, hence unclassified governmental documents, as well as academic pieces and reliable news articles make for the most accurate tool to carry out this research.

We will first proceed to analyze whether AI can be considered revolutionary enough for the military world to be identified as an RMA. Only after this part will we take into consideration the impact of strategic culture. We intend to proceed in such a way because we stipulate that, although strategic culture is crucial in understanding specific countries' development of the

AI-RMA, its consideration is not necessary to answer the main question of this thesis. Even more so, taking strategic culture into account earlier on would only make the process of answering this question less accurate, as too many variables would risk creating too many exceptions. Hence, only when a general understanding of whether there is or there could be an AI-RMA will be reached will we look at strategic culture.

Artificial Intelligence as a Revolution in Military Affairs: reality or fiction?

To prove that AI can indeed be considered the upcoming RMA, this chapter will look at elements and features specific to the concept of RMA that can be found in the current implementation of artificial intelligence in the military sector. As previously stated, an RMA is a radical change in military innovation and technological advance. Further, the way in which these are implemented is crucial, and the changes caused by an RMA need to be transformational for it to be considered as such. We will look at whether AI's main features fit the 'mold' of a possible RMA or not.

As indicated in the previous section, this thesis will initially proceed by momentarily ignoring the social context of specific countries around which a possible AI-RMA is developing, focusing instead on proving that AI has the technological potential to be seen as a revolutionizing technology for military affairs. In order to assess this, the three levels of war that all need to be revolutionized by an RMA for it to be considered as such will be analyzed vis a vis the impact that AI can have on each one of them. Only after having proved AI's technological potential will we turn to analyze the role of the culture in which this technology is implemented, to form a holistic understanding of the subject at hand.

AI already has noteworthy effects on military affairs, as seen before regarding the current applications of this technology to the military world. However, it is in its technological potential that we argue AI can be recognized as an RMA. Ali et al. stress that said potential is vast and compelling, and that its beginning can already be witnessed. From robotics and autonomous weapons, passing through intelligent electronic warfare systems and military

artificial intelligence machine translation systems, AI and the emergence of new, cutting edge technologies based on it will cause seismic changes "*in the armed forces' strategies, planning, and organization*" (Ali, Shehzad, Farid Farooq 2021). Pereira Mendes, legal researcher at Finabel[5], agrees with the previous point. According to him, AI has a groundbreaking potential in regards to military affairs that extend well beyond autonomous weapons (Pereira Mendes 2021). More specifically, he goes as far as to say that AI is a potentially disruptive technology that may drastically change the conduct of warfare, all the while bringing along radical military improvements on the battlefield. In turn, this effects will completely change the way war is waged (Ibid.).

AI appears therefore to have great potential when it comes to military affairs. To see whether this can translate to a full-bloomed RMA, said potential will be now analyzed for the three levels of war, to see if it applies to all of them and, more importantly, if for all of them it can be seen as revolutionary.

The impact of AI on the tactical level through the lens of AWS and autonomous vehicles

As far as the impact that AI can have on the tactical level is concerned, autonomous and semi-autonomous weapon systems are most definitely a worthy starting point for its analysis. Caron states that a weapon system is autonomous if unmanned and able to detect a target and decide to use lethal force against it with no human interference whatsoever. On the other hand, if some sort of human interaction is necessary for its functioning, even though the system is still unmanned, this will only be semi-autonomous (Caron 2020). Semi-autonomous weapon

[5] Finabel is a European organization under the control of the Army Chiefs of Staff, aimed at developing a common European conception of defense problems (Noël 2011).

systems are nowadays present and used in the battlefield by a majority of countries. However, it is worth pointing out that, on the other hand, fully autonomous weapon systems are not. In short, the reason for this is that such systems "*do not yet exist*" (Solovyeva Hynek 2018). The only exception are defensive weapon systems, such as those introduced in the previous chapter. Importantly, even in this case, these can only operate in pre-delimitated areas and are primarily targeted at non-human objectives. Further, it is still up to human operators to decide where these weapons are deployed and, at any given moment, it is possible to intervene and shut these systems down (Ibid.). It is clear that human interaction, or at the very least supervision, is still necessary for these kinds of systems to operate. It must be noted, however, that in more recent times there have been episodes in which the use of what could be defined as a fully autonomous weapon system (hereinafter referred to as AWS) has been reported. Specifically, according to a report of the United Nations Security Council, a Kargu-2 is recognized to have targeted and carried out an attack in a fully autonomous manner, with no connection between the machine and a human operator. The Turkish-manufactured drone is said to have hunted down its target completely on its own, during a military operation in Libya in 2020 (Froelich 2021). Nonetheless, this stands out as an exception. Even if there were more of these events, it would still be safe to see them as isolated cases.

Concerning semi-autonomous weapon systems, both offensive and defensive, despite a specific control from a human operator, these still possess a certain degree of autonomy based on AI systems. This autonomy can apply to their navigation, image recognition systems and, for defensive purposes, targeting and firing. However, there is currently a strong interest in this field, which makes it so that these systems and technology are witnessing radical improvements. According to Sullivan, the "*development of such systems is moving faster than that of nuclear weapons, and it's accelerating*" (Sullivan 2021). Furthermore, although

prototypes of offensive AWS are still in their infancy, a certain feeling of urgency perceived by countries such as the United States may push governments to deploy these systems ahead of schedule (Ibid.). Before long, therefore, battlefields could witness the deployment of AWS. With these technologies growing leaps and bounds, human operators will not only see an increasingly growing distance between them and military action, as is already the case, they will also be detached from the very same decision to kill. Taken to the extreme, AWS would get rid of human judgment altogether. The potential impact of such an event on the tactical level of war appears revolutionary, with noteworthy consequences. Amongst these, the possibility of an increasingly unmanned battlefield stands out. As wars are waged and fought through machines with no link to humans, we could soon witness a decrease in war casualties. With an ever-growing number of soldiers removed from action, and with machines taking over their role, damages inflicted by countries on one another will be predominantly economic. Although this next scenario is highly contested, a complete automation of warfare would even cause war to "*cease to be a desirable option by nation-states as a means of resolving their differences*" (Solovyeva Hynek 2018). There are, however, more plausible and foreseeable consequences as well. Autonomous weapons are seen as a force multiplier: their use would allow for a smaller number of warfighters to be deployed, allowing to achieve greater efficiency. Further, it is also argued that AWS could expand the battlefield, allowing to reach areas that would be inaccessible to soldiers, such as natural environments hostile to human life (Etzioni Etzioni 2017). In addition, AWSs are better suited than humans for those military missions that are "*dull, dirty, or dangerous*" (Ibid.).

Up to this point, the thesis' argument regarding the tactical level has been almost entirely focused on the literal weaponization of AI. In other words, those weapons affecting the battlefield directly. This is however only a small part of the impact of AI on said level. Indeed,

there is another noteworthy application of AI that has the potential of strongly reshaping the tactical level of war: military robotics. Also defined as 'unmanned vehicles', military robotics include numerous systems, such as the previously analyzed AWSs. However, in this specific case, the focus in regards to military robotics will be centered around unmanned vehicles, whether they are aerial, maritime, or surface. Renowned experts have agreed that it is now only a matter of years before fully autonomous armed-unmanned aerial vehicles (hereinafter referred to as UAVs) are deployed (Johnson 2019). As a matter of fact, the field of robotics is expected to witness an increase in investment "*from just over $15 billion in 2010 to about $67 billion by 2025*" (Sander Wolfgang 2014). Specifically, military robotics should experience an increase of $11.4 billion in investment, as shown in Fig.1.

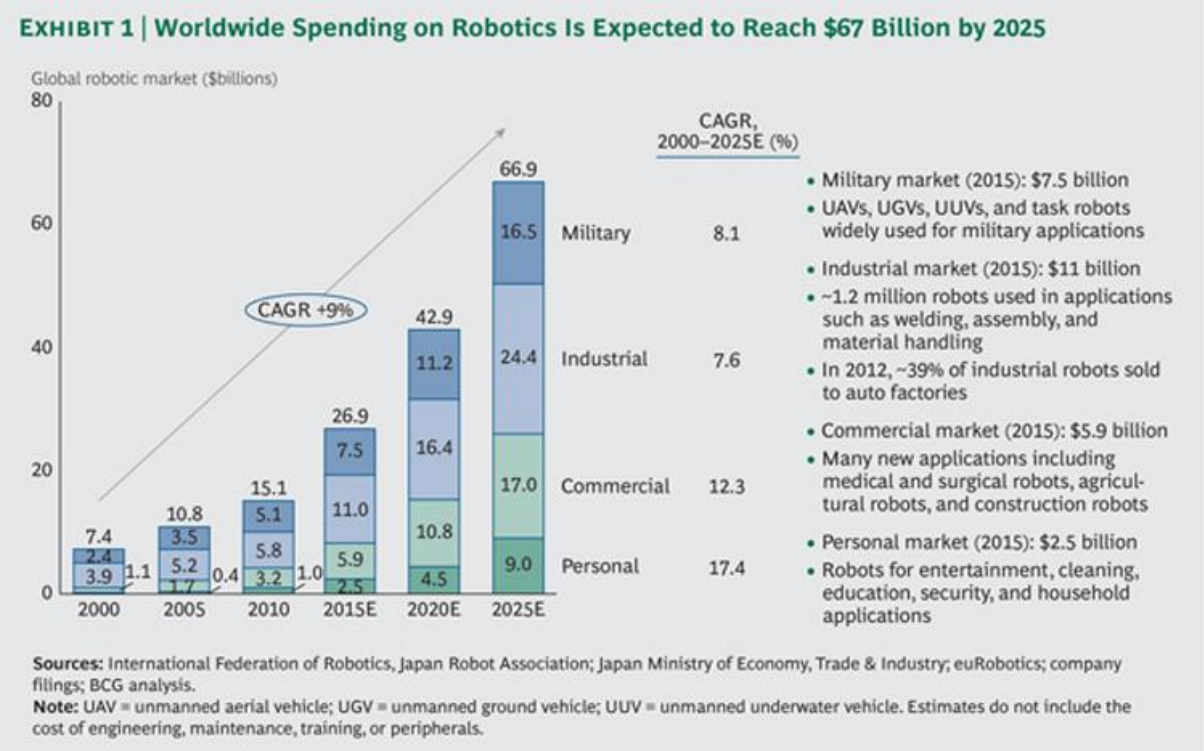


Figure 1 (Sander Wolfgang 2014)

Newer estimates foresee an even greater increase in investments, with worldwide spending on robotics and drones expected to reach $241.4 billion by 2023 (Leonard 2020). Autonomous unmanned vehicles could be soon equipped with AI technologies that would allow them to carry out a range of operations. AI tools such as visual perception and facial recognition have the technological potential of allowing these systems to operate in a completely unsupervised and independent manner (Johnson 2019). At the tactical level, the potential stemming from the deployment of said vehicles is vast. For instance, UAVs equipped with stealth technology will have the ability to penetrate state of the art air defense systems, drastically impacting the ability of states to defend themselves from aerial attacks (Ibid.). Further, autonomous unmanned vehicles will also grant those countries equipped with such technology tactical advantages especially in maritime operations, making for a more powerful and far-reaching presence in contested zones. For instance, looking at China, unmanned sea-based drones could improve China's monitoring and controlling of the South China Sea to such a degree that it could potentially prevent the U.S. from carrying out maneuvers in that area, hence causing it to lose a key tactical, as well as strategic, military position (Ibid.).

Finally, even before the time in which autonomous unmanned vehicles will be largely employed, AI can still have an important impact on the tactical level of maritime operations. Specifically, this is the case of 'automated decision aids' and 'battle management aids' used to support the warfighter (Johnson Treadway 2019). These aids, through AI, allow for "*improving combat identification, identifying and assessing tactical courses of action, coordinating distributed warfare resources, and incorporating predictive war-gaming into tactical decisions*" (Ibid.). At the service of human operators and warfighters, these services have the potential to drastically impact maritime warfare, providing those that hold such technology with tactical superiority.

The effects of AI on information gathering at the operational level

The application of AI to warfare has the potential of greatly impacting its operational level. Such are the findings of several specialized articles and papers. Olivia Lazaro, a Major of the U.S. Army, stipulates that if applied correctly, AI can give access to a great amount of information with minimal risk related to its acquisition, hence providing a disproportionate military advantage to those countries that first would develop and employ such technology (Lazaro 2018). The options that become available to commanders with such a wide access to sensitive information are unprecedented, with the potential of reshaping the operational environment. According to Lazaro, the related advantages are numerous and crucial, chief amongst which is the fact that no forces need to be deployed in operations aimed at acquiring information through AI military systems. This allows for these kinds of operations to start "*long before troop movements begin*", all the while also allowing "*military commanders to conduct operations deep behind enemy lines with little to no political risk*" (Ibid.). The advantages discussed by the author all fall in the domain of the information environment, which also comprises other military operations included in what could be best defined as a grey zone in which militaries operate. For instance, social media can become a useful tool to gather intelligence regarding enemies' plans, locations, and *modi operandi*, all of which can then be used to perfect military operational processes (Ibid.). McKendrick's work also reports that AI has great potential in influencing and reshaping both the operational and strategic levels of war (McKendrick 2017). She highlights a similar point to that of Lazaro, identifying in information flows a main characteristic of the operational level. For this reason, a system that could make the process of collecting information faster and safer would most certainly positively influence the entire level of operationalization. More specifically, the author stipulates that processes

such as the one mentioned above are nowadays digitalized in their entirety, with the possibility of making them autonomous or semi-autonomous through AI having a crucial value (Ibid.). To provide a less theoretical and more practical overview of the actual systems that can be implemented to improve the operational planning processes it is useful to look at how these processes are shaped. In order to do so, we will follow in McKendrick's footsteps and look at the operation planning processes of the North Atlantic Treaty Organization (hereinafter referred to as NATO) as an example. NATO's planning activities are described in and must respect NATO's operations planning process (hereinafter referred to as OPP), and they are enacted by operation planning groups (hereinafter referred to as OPG) (Fazekas 2021). Once again, even in regards to NATO, it is in the information acquisition and analysis process that the application of AI seems to be most useful. As a matter of fact, because of the vast technological advances of the last decades, analysts and organizers now have access to such a vast amount of information that it becomes unreasonable to believe that it could be processed in its entirety by human brains (Ibid.). For these reasons, tools have already been developed to help categorize and filter pieces of information to be able to make the best out of them. For instance, analysts operate in groups in order to prevent mistakes that could be caused by exhaustion or distraction of a single operator if left alone in handling all the necessary information available for a specific operation. Further, down to the last member, teams are kept the same throughout the entire duration of an operation. This makes it so that OPGs are made only of the most knowledgeable people regarding specific situations. All these provisions are taken to assure the best operation planning, as well as the best reactions of the team to possible problematic developments of the situation. However, these methods are still extremely human-based. It is sensible to state that the implementation of AI in operation planning processes would be beneficial to their functions. What is being suggested here is not a fully autonomous AI-based operation planning process. As a matter of fact, despite the great advance that

technology has been witnessing in the past years, we are still far away from AI systems capable of fully taking over humans' roles in specific fields (Makarov 2020). As previously explained AI systems, amongst which can be found ML systems that allow for predictive analysis, operate based on sets of data provided by human operators through algorithms. Further, in doing so, they are developed for specific situations and tasks. If the situation changes, making the provided data unreliable, the support provided by AI becomes meaningless, if not detrimental. For this reason, the solution seems to be for OPPs to still be planned by OPGs, but with the aid of AI in those steps that allow for it. Fig.2 provides a list of the sectors most likely to benefit from AI in OPP.

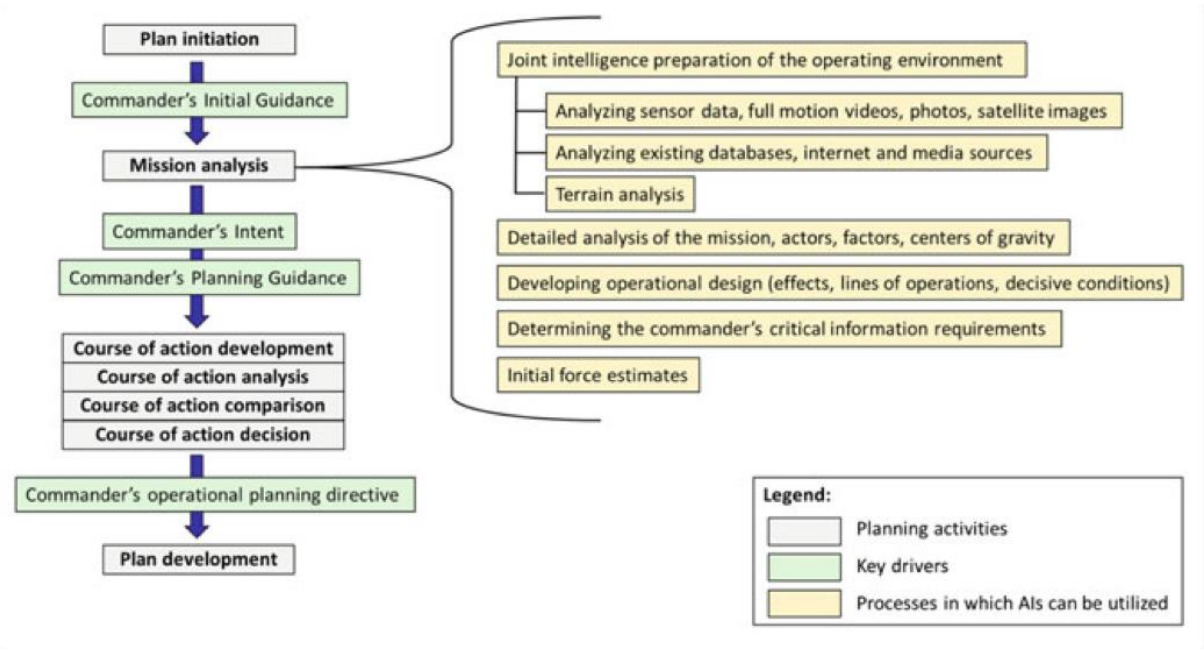


Figure 2 (Fazekas 2021)

This figure depicts NATO's guideline for operational planning. Within the activity of mission analysis, Fazekas provides practical activities which lend themselves to improvement through AI. The various steps highlighted by the author in yellow require an extremely in-depth analysis of raw data that can become a very time-consuming process when carried out by human analysts. On the other hand, AI systems tasked with autonomously recognizing images,

translating conversations, and making reliable predictions in quite short amounts of time with a lesser risk of human error have proved trustworthy (Agrawal, Gans Goldfarb 2017). The application of such programs to the aforementioned steps would most definitely bring a huge improvement to the operational planning altogether. The use of AI as depicted above has one noteworthy consequence: that of saving time. A less time-consuming planning, alongside quicker reaction times to unexpected events as operations are unfolding, makes for a crucial progress. Similar developments have already been applied in private and public realities of the civil world, with evidence showing a great deal of noteworthy positive consequences. Businesses of various nature have seen their operations benefiting from the application of such systems (Tariq, Poulin Abonamah 2021), and with the military world also implementing such technologies it is safe to say that similar outcomes are to be expected.

AI at the strategic level: a shock to international relations

In regards to the effects on the strategic level carried by the implementation of AI, these are notable in both their number and scope. According to Payne, above all AI will potentially change the power balance in the international arena (Payne 2018). With the adoption and application of AI systems in their respective military sectors, countries will witness important transformations regarding the role of their "*legacy military capabilities*" (Ibid.). Strong traditional armies will witness their role become secondary to the potential of AI military systems, with those countries that manage to acquire an advantage in the technological development of the latter potentially taking over those historically considered as military leading powers. Even more so, evidence is now pointing towards the indication that even just a minimal advantage in the technological development of AI military systems will have a disproportionate effect on the battlefield, consequently having a similar effect on the current

international status quo. Becchi and Shaleva insist on the potential that AI has in reforming the international balance of power, offering examples of fields that will be strongly reshaped by its application, such as military technologies and espionage (Becchi Shaleva 2021). Countries able to quickly reach advantages in these areas will have the opportunity of asserting a dominant role in terms of military power, regardless of their more traditional military capabilities. As far as espionage is concerned, AI would most certainly allow for a broader and more accurate collection of data useful in the process of strategic decision-making. Notwithstanding this contribution, even more noteworthy would be the role that AI can have in preventing the very same attacks being carried out through AI systems: artificial intelligence can and shall be the strongest defense against itself. More precisely, if we refer to the examples of deepfakes and cyberwarfare provided in the previous chapters, AI systems can flag anomalies in the cyberspace unnoticeable to the naked eye, identifying possible attacks before they happen (Ibid.). So far, most of the current efforts aimed towards this direction have focused on the automated detection of these threats. For instance, automated deepfake detection sees the use of algorithms "*to discern if a specific image, audio clip, or video has been substantially modified from an original*" (Engler 2019).

The application of AI to warfare, specifically regarding semi-autonomous and autonomous weapon systems, involves a second crucial change in the military strategic decision making process. With these systems becoming more available, the need for human soldiers to fight against one another on the battlefield would gradually become unnecessary. As warfare becomes increasingly more unmanned, many military lives that are lost in war zones could be spared. Further, the deployment of these systems could also be carried out as an economic strategy: in 2013, it was estimated that each soldier in Afghanistan costed the U.S. DoD $850,000 per year, with some putting that number as high as $1.2 million (Francis 2013).

Compared to the production and maintenance costs of AWS, it is clear why the latter would be the preferred choice. The aforementioned Korean SGR-A1, for instance, has a cost per unit of $200,000. Even systems programmed for more offensive stances still allow to keep the expenses relatively low: the Foster-Miller TALON, a military robot designed for combat missions, costs $230,000 a piece (Ibid.).

These two reasons would push for a considerable deployment of autonomous and semi-autonomous weapon systems on the battlefield by those countries that have developed such technologies. The effects of this phenomenon are twofold. On the one hand, opponents to these military systems argue that as these machines would not only allow to reduce the cost of human lives on the battlefield, but also the economic costs of warfare altogether, countries may resort to armed conflicts more often than today and for less severe reasons. If a country has less to lose, it could be more inclined to engage in combat, with AWS potentially "*lowering the threshold for engaging in war*" (Kovic 2018). As a consequence, war could possibly become much more widespread than it is today, reaching areas and countries that have been spared in the last decades. Further, we stipulate that the low cost linked to engaging in a conflict would make even those countries that are historically less prone to engage in such hostilities reevaluate their stance on the matter. On the other hand, as the costs of war would become mainly economic and not human, countries may very well be willing to put up against offensive military operations for much longer, as the images of their own soldiers dying at the front would be a thing of the past. This would discourage "*aggression*[s] *by adventurers seeking easy gains that are no longer below the threshold for intervention*" (Payne 2018). The amount of ongoing conflicts could hence decrease. Regardless of which of these two consequences will be the dominant, both have the potential of deteriorating or altering current alliances. Countries that already have well-developed technological research laboratories, alongside the economic and political will of dedicating them to military affairs, will be able to acquire cutting-edge AI

military systems. On the contrary, countries that lack the means to achieve such results will be left behind, dealing with more traditional consequences vis a vis their participation in a conflict. As both these typologies of states could be found inside of a military alliance, members not possessing advanced AI capabilities would be strongly incentivized not to support military operations that would constitute for them greater risks than those posed to countries with AI systems. Consequently, despite generating possible quarrels amongst members, this situation may lead less-advanced countries to reduce their role to that of a client-state (Ibid.). In the Guide to international relations and diplomacy, a client-state is described as a country that depends on the support of another one, known as patron (Fry, Goldstein Langhorne 2002). Said support can be political, economic, and military and, although this relation is usually beneficial to both actors (Ibid.), it appears sensible to state that a stance reminiscent of political clientelism[6] is inherently asymmetrical. Patrons, in providing crucial support to their client-states, hold a certain power over them, as interrupting this relation could have quite a costly impact on the country relying on external support. In the specific case of AI military systems, members lacking these technologies have no choice but to rely on those who have developed and utilized them. The alternative does not seem feasible, as it would mean isolating oneself against the potential threat of this technology. Furthermore, as memberships in alliances usually include the respect of certain duties, members may have no choice but to be involved in a conflict (McInnis 2020). Without this cutting-edge technology, their only choice would be to look for external support. The unbalance that this entire situation brings between member-states is enough to reshape the status quo of alliances, giving patrons of AI military technology a dominant position over other members.

[6] "*Political clientelism, the giving of material resources as a quid pro quo for political support, is best understood as part of an ongoing exchange between patron and client, with threats of defection instead of, or perhaps in addition to, norms of reciprocity sustaining it*" (Stokes 2011).

A further consideration is necessary when thinking about the strategic impact of AI: the possible consequences of this phenomenon on the international offense-defense balance system (Payne 2018). Again, in this case, a different analysis of the situation leads to mainly two outcomes: a switch to either a more offensive or defensive stance. As this is a topic that keeps evolving, findings concerning its effects are not definitive. However, there appears to be an academic consensus on the following idea. If AI's impact shifts the focus toward an offensive stance, the world would likely witness a negative development of current international relations, with countries being both more prone to behave aggressively and more worried about being attacked, consequently leading to an increase in conflicts. Vice versa, a more defensive position would hypothetically contribute to stabilizing international confrontations, reducing the possibility of wars breaking out (Jervis 1978).

Authors such as Payne argues that AI will tip the scales in favor of an offensive stance (Payne 2018). Contrary to the case of nuclear weapons, state of the art AI would arguably be powerful enough to render enemy defense systems useless with just a first strike. Further, the use of AI systems does not involve a material loss of the military equipment used in the operation, as it would be the case if missiles were used. Insisting on Clausewitz's theory that humans are loss averse, the idea of being able to carry out an attack without registering any loss in either human lives or military equipment is a strong incentive to behave offensively (Ibid.). Payne presents yet another reason as to why he predicts this development, comparing AI to nuclear weapons. Whereas less powerful countries have managed to deter militarily superior ones by getting ahold of nuclear armaments, this would not be the case with AI. As these systems would allow preventing enemies from being able to enforce a second strike, the deterrence that is now granted by the possession of nuclear weapons would cease to be relevant. AI deterrence, therefore, would not be a relevant practice. This last point is of particular interest to this thesis:

as previously mentioned, the importance of a new RMA in the current world appears necessary to move over the stalemate caused by the previous nuclear RMA. Considering that AI technologies would give countries the power to carry out a first-strike attack that would also disable the nuclear armament of the targeted country, nuclear weapons would quickly become inadequate, as the AI RMA spreads around the world. With nuclear deterrence losing its strategic value, countries may be inclined to give up on nuclear weapons altogether, focusing instead on new ways to wage war. This, in turn, would allow the international arena to move over the nuclear stalemate it currently finds itself in.

Garfinkel and Dafoe, stipulate that it is still too early to have a clear understanding of the effects of AI on the international offense-defense balance system (Garfinkel Dafoe 2019). In their work, they offer different possible outcomes of this situation. It is worth taking into consideration the possibility they offer regarding a shift towards a more defensive stance in the international arena as a result of AI. They do so by quoting, among others, the work of Schneier. His research reaches the opposite conclusion than Payne's, stipulating that, although at first the offensive stance would take over the defensive one, in the long term the effects of AI on strategic thinking would lead to the stabilization of the international scene in a defensive behavior (Ibid ; Schneier 2019).

Regardless of the effect that AI will have in this regard, it appears clear that it will influence the current international offense-defense balance, hence being responsible for critical changes at the strategic level of war.

Findings pertaining to the effects of AI on the three levels of war

Through the analysis of the impact that artificial intelligence can have on all the three levels of war, it is clear that in every case it has the potential of being revolutionary. As a matter of fact, the changes shown in this chapter represent more than a simple evolution of how war is fought, planned, and thought of. Further, the same can be said in regards to how the international balance is affected by how new technologies allow countries to wage war. Not an evolution, with the achievement of the full potential AI can offer the world will witness a revolution extending outside of the military world's borders, as its consequences would impact the political and societal status quo of today's society. It must be pointed out that the idea of 'full potential of AI' is critical in the understanding of the AI-RMA. As a matter of fact, many of the effects caused by AI on the three levels of war that were discussed in this chapter are still currently in their infancy. These are not mere speculations however, as the history behind these technologies has proved that there is space for a vast and rapid improvement which, in due time, will allow reaching the ideas presented insofar. Not only this, research projects and prototypes that will make this possible are advancing relentlessly, with both the private and public sectors investing extensive amounts of money and knowledge (Mousavizadeh, MehtaDarrah 2021). What seemed impossible when for the first time the idea of AI was linked to military affairs is not only possible today, but has already been made obsolete by newer technological achievements. For these reasons, we stipulate that the world is now witnessing the initial phases of what will soon be the full-blown AI-RMA. These phases are characterized by the processes and the discoveries that are paving the way for the AI-RMA, but do not yet constitute it in its entirety. This is not an exception: the nuclear RMA as well was preceded by meticulous studies, experiments, and technological advances that allowed to weaponize specific nuclear reactions (Blakemore 2020). The preceding phase of the AI RMA, however,

can be expected to take longer than that of the nuclear RMA, due to the extremely vast reach that artificial intelligence could have.

The Cases of the United States and China through the lens of strategic culture

As mentioned throughout the previous chapters, AI systems do not simply apply to the use of force in a more conventional way. Although a large body of experts is focusing on their use in regards to weapons and equipment to be deployed directly on the battlefield, there is a similar effort in applying AI to any number of military-related activities, from operation planning all the way to cyber warfare. Drawing a parallel with the nuclear RMA, the AI-RMA stands out for its chameleonic nature. In simple terms, to understand whether the nuclear RMA had reached a specific country all that was needed was to verify whether that country owned any number of nuclear warheads. However, as AI can be applied in many different ways to military affairs, the way through which a specific country enforces the AI-RMA could differ greatly from that of another country. For this reason, we argue that the understanding of a more universal AI-RMA is only complete when also looking at how specific countries implement it. Depending on the country, the AI-RMA will arguably be shaped differently. It is in this regard that the concept of strategic culture as previously analyzed becomes crucial to this work. We argue that countries' respective strategic cultures play a considerable role in how the AI-RMA comes to be. To corroborate this matter, the cases of the United States and China will be taken into consideration.

These two countries, and their relations, are particularly remarkable as much of their respective interactions are based on a long-term rivalry. This phenomenon is not solely based on geopolitical reasons, with its causes being strongly rooted in their different and conflicting ideologies, as well as in them both striving for hegemony (Lungu, 2021).

The United States and China appear to be the two greatest driving forces when it comes to artificial intelligence technology's progress worldwide. As a matter of fact, many experts in the field would argue that the rivalry between these two powers can be found at the base of their respective efforts to develop cutting-edge AI technology, concerned that one may overtake the other as a leading global power (Dinic 2022). It is interesting to notice how a potential collaboration between these two countries is seen as a stronger force than their rivalry for the progress of AI. Beijing and Washington have a history of cooperation in specific sectors, and when it comes to AI applications these are found in the fields of medical research and academia. However, diverging values between China and the United States are proving harmful to this cooperation, damaging its progress in those areas where cooperation exists and making it impossible for it to occur in others such as the military sector (Sullivan 2021). This situation seems to be giving China an advantage: it leaves the United States in need of partners and allies to cooperate with, without which American AI growth would be at risk of stagnating. Washington may be inclined to naturally look at countries that share similar values in the form of other liberal democracies. However, similar values do not mean similar conceptions on how to handle the intricate sharing of data. This could prove detrimental to the desire of the U.S. and other liberal democracies to establish a path concerning the coordination and creation of new organizations deemed necessary in response to AI's ever-growing role in society. If these countries fail at this, China would likely fill this need (Ibid.). A country, China, that contrary to the United States is not in dire need of partners for Chinese AI growth to be successful. Indeed, the Chinese government has been implementing successful strategies aimed at gathering as much data as possible, with a complying population making this task easier. Consequently, all this information is giving a crucial advantage in developing AI vis a vis the United States.

In the civil sphere, China would already seem to have taken a significant lead compared to the United States, one that it is not likely to let go of. The Chinese population is significantly more accepting of the idea of a 'surveillance state' than their Western counterparts, and this has allowed Beijing to collect an outstanding amount of personal data in the last few years. As a consequence, the country has been able to introduce instruments such as the Social Credit System[7], whose functioning is based on facial recognition and data analysis technologies powered by artificial intelligence algorithms (Ibid ; Allison 2019). On the other hand, Americans are more reluctant to share their personal data for similar purposes to their governments. This feeling translates in strict privacy laws and a limited cooperation between private companies and the government, all of which prevents an improvement in artificial intelligence comparable to that of China.

When it comes to the military sphere, as of 2022 Washington is still the leading actor in the field. However, this position could be soon challenged by Beijing's ambitions and efforts. Whereas the Chinese government is actively investing in research and development of AI technology, when it comes to the United States this role is still largely played by private firms, often with no support by the American government (Dinic 2022). Consequently, possible technological advances could take longer to translate from the private to the military sector. Without going into too much detail on which country is more likely to get established as the leading AI international actor, it can be safely stated that both the U.S. and China are implementing the most AI technology to their respective military affairs. However, the way in which this is being done differs between countries. We stipulate that their respective strategic cultures are a key element in understanding the reasons behind these disparities. For the

[7] An instrument launched by the Chinese Communist Party in 2014 "*to monitor the behavior of ordinary citizens and use it for offering benefits or limiting privileges*" (Dinic 2022).

purpose of this argument, strategies based on the AI-RMA may be considered to be implemented in manners that can fall in two distinct categories: the use of AI in lethal weapon systems, hance making the battlefield increasingly unmanned, or its application with information and cyber warfare purposes.

China

Kanya presents an analysis of artificial intelligence's role in China's revolution in military affairs and finds that the People's Liberation Army (hereinafter referred to as PLA) will likely approach this new technology differently from its American counterpart. According to the author, Chinese strategic culture plays a crucial role in this (Kania 2021). Technology, and the ability to best implement it in its military affairs is seen as a vital component of Beijing's strategic culture. This idea is best expressed through the saying 'technology determines tactics' (技术决定战术) (Blasko 2011). At the same time, however, technology does not determine strategy, which is based on China's pursuit of a policy "*featuring self- defense and gaining mastery by striking only after the enemy has struck*", hence opposing any possibility of a preemptive strike or unprovoked attack from China (Ibid). As vital as technology is perceived as, it is essential to establish that its main role is to improve this broader strategy. This concept is reflected by how AI is being approached: as military attacks are to be avoided, China's main take on militarized AI is not primarily focused on lethal autonomous weapon systems. Instead, "*the Chinese focus is currently on developing AI technology, methods, and tactics to precisely target key elements within an enemy system-of-systems*" (Dahm 2020). This can be achieved by carrying out cyber-attacks targeted at the enemy's information networks, preventing the enemy from functioning properly. China's objective is therefore to have the capabilities of completely paralyzing a potential opposing country without having to initially wage a more

traditional war on the battlefield. As technology is nowadays a vital component of almost every aspect of the life of a country, the success of this strategy may be enough to quickly claim a victory. Naturally, as cyber-attacks are not infallible, Beijing is not ignoring the potential application of artificial intelligence to the battlefield, and is actively investing in and developing AWSs (Haner Garcia 2019). However, these are seen mainly as a secondary focus by China, mostly as a follow-up step to the information-systems paralysis strategy if this would turn out not to be effective enough (Dahm 2020). This conceptualization corresponds with the current long-lasting Chinese tradition of understanding military power not based on the numbers of one country's forces, but on its military information systems-of-systems (hereinafter referred to as SoS). In this case, SoSs represent the conjunction of all the singular military systems that one country might have acquired individually, but that need to work in unison to achieve their full potential (Dahmann 2015). SoSs are growing vaster and more intricate, making it extremely challenging for human operators to supervise. AI is seen as the perfect technology to manage these systems in the future. As China's main strategy is developing the ability to paralyze an enemy country without deploying any 'conventional weapons' (including offensive AWS), the way in which the PLA is approaching the AI-RMA just makes sense. Dahm expresses this concept egregiously stating that Beijing seeks "*to use AI to deliver precise effects to immobilize their adversary while defending* [its] *own system-of-systems*" (Dahm 2020). The crucial role AI has and is bound to have in China's strategic development is recognized even at the highest levels of Beijing's halls of power, with General Secretary Xi Jinping having strongly advocated to his party the importance of developing these technologies (von Carnap 2022).

Based on Chinese strategic culture, the levels of war that appear to be the most likely to benefit from the technological potential of AI are the operational and strategic ones. As far as the

tactical level is concerned, this as well is arguably bound to experience noteworthy effects stemming from the implementation of AI. However, as Beijing's preferred course of action appears to be that of avoiding initiating a conflict, based on its long-lasting strategic culture tradition, the second and third levels make for a more sensible area of interest. In regards to the second, with the great effort that the world is witnessing from the part of China to develop AI-cyber systems able to pierce through foreign countries' SoS, this country has the potential to impose itself as the dominant nation in regards to data gathering and espionage, an effect that was analyzed in the previous chapter. This is coherent with the Chinese approach to military affairs, as it would allow it to hold great international power without having to initiate a conflict. Further, in case China would find itself dragged into a conflict, these systems would be just as important in providing the PLA with tactical advantage and fast and receptive operational plannings. At the same time, based on the main technologies on which it is focusing its attention, these would arguably influence war at its strategic level. Specifically, the Chinese AI-RMA has the potential of elevating China's place in the international arena, and amongst its allies, to an even greater level than that of today. As China's focus on information military strategies appears to be unmatched to this day, it is unlikely that its current position in this regard will be challenged soon. Consequently, a more China-centric international arena can be expected, with consequences reverberating also in those alliances in which China is a member.

The United States

Looking at the United States, the emphasis regarding the application of AI in military affairs appears to be on weaponry. U.S. strategic culture is a key factor in understanding why, with the country preferring to wage "*wars of annihilation against conventional enemies that can be accomplished in short time frames by employing lavish firepower in "an aggressive hunt for*

the main body of the foe" (Johnson 2020). As the possibility of quickly annihilating the enemy forces is of great appeal to the United States, focusing on emerging technologies to primarily develop cutting-edge, state of the art weapons appears to be a priority. This understanding of warfare is strongly rooted in the U.S. strategic culture, and it is not likely to change any time soon. As a matter of fact, it can be found as a consistent idea throughout the evolution of the country. America's history is one filled with grand battles and the idea of fighting for the survival and spread of fundamental human and political rights and freedoms. Hence, in American strategic culture war is perceived positively, with excitement regarding the possibility of fighting for what is good. A conceptualization of war that is the full expression of the aforementioned quote by Johnson: the idea that the best possible outcome is to swiftly and aggressively crush the enemy's forces up to their highest level. To this point, Lippman makes a noteworthy contribution to the discussion by stating that the United States does not see itself simply as a country like many, and that an attack against America is "*an armed rebellion against the universal and eternal principles of the world society. No war can end rightly, therefore, except by the unconditional surrender of the aggressor nation and by the overthrow and transformation of its political regime*" (Lippmann 1952). This understanding of war is so entrenched in America's strategic culture that not even its vaster experience with unconventional conflicts than conventional ones has changed it. Unconventional wars, such as those involving guerilla warfare, stand out as those experiences in which the study and understanding of many variables such as elements characterizing the enemy, terrain conformation, geopolitics, and the history of that country are recognized to be more beneficial than a 'guns blazing' approach. However, the U.S. have repeatedly failed to integrate this knowledge in their strategies, with some infamous consequences such as the War in Vietnam (Menand 2018). This consistency in addressing warfare relying on its military and technological superiority is simply too rooted in its military culture for the United States to

disregard it, which explains why even when it comes to AI-RMA the main focus is on the development of new and improved weapons systems.

The previously discussed stance on the AI-RMA can be explained also through another key characteristic of U.S. strategic culture: its overreliance on technology and on its technological superiority. This trait is closely linked to how warfare is seen by the U.S., and contributes to its problematic development. America has been a leading country in technological development for a great part of its history. Since the beginning of the Cold War, the world has witnessed impressive breakthroughs carried out by the U.S. in the field of technology, such as spearheading the internet (Darby Sewall 2021). These improvements naturally transferred to the military sphere as well, making the U.S. army the most advanced army in the world. This status is nowadays challenged by other countries such as China, with some already postulating that the Chinese army has overtaken its American counterpart (Ryan 2021). As technology has once given its army the status of the world's greatest, technology is still looked at as the answer to every conflict. More specifically, highly technological weapon systems are. It does not matter if history has proved this idea wrong, as with the previously mentioned case of the Vietnam War. With the generational turnover that has interested American military spheres, those that had experienced first-hand the defeats caused by over relying on technology in Vietnam have been replaced. New officers have not learnt this lesson, as they are attracted to the idea of technology and confident in its ability to once again make the U.S. army the leading military force in the world (Murray 1999). This overstressed trust in technology, together with how warfare is culturally seen, naturally translate into an implementation of AI that mainly looks at firepower and field operations.

These strategies reflect, and are coupled with, yet another feature, which is America's historic industrial approach to war (Mahnken 2006). An exemplification of this approach is represented by the fact that during the first year of its participation in World War II, the United States' production of aircraft, tanks, and heavy guns was superior to that of the entire Axis (Ibid. ; Overy 2006). One of the main characteristics that emerge from this attitude is the "*lavish use of firepower*" to which the American army resorts to (Mahnken 2006). This, in turn, fits within the previously highlighted points of heavily relying on technology and preferring direct and severe approaches to combat. Whereas state of the art technology can allow to increase the intensity and quantity of firepower, a hefty use of the latter can be seen as facilitating the overarching goal of swiftly and drastically defeating the enemy. These separate traits can therefore be seen as part of a vicious circle representing the main characteristics of the American strategic culture that feed into one another. When applied to the implementation of AI in military affairs, this understanding reverberates more through the idea of making warfare unmanned than it does through information and cyber warfare.

Based on these previous points, it appears that the tactical level of war will experience most of the potential effects of the American AI-RMA. The characterizing elements of the American strategic culture all point to this level as potentially experiencing the most noteworthy consequences, based on Washington's notable interest in developing AWS and autonomous vehicles. As a consequence, the U.S. Army should potentially experience all of the main consequences previously highlighted, from getting hold of technologies able to multiply the effectiveness of military force to being able to conduct operations in scenarios that would have been impossible to reach by human soldiers.

As with the case of China, the American inclination to focus the application of AI on a specific aspect of modern warfare does not translate to a lack of its application in other military fields as well. For instance, the U.S. Army has been developing AI cyber-systems aimed at detecting and preventing possible foreign intrusion into its information systems (Valori 2022). Similarly, two years after having established the Joint Artificial Intelligence Center (JAIC) in 2018, this Pentagon's organization has launched new projects regarding cyberoperations and information warfare (Pomerleau 2020). However, as the quite recent creation of JAIC proves, there is a clear emphasis on firepower and operation strategies vis a vis cyber and information strategies. Vice versa, China has shown a preference towards the latter, while still developing to a lesser degree the former. Dahm clearly presents the situation by stating that "*While there is certainly overlap with U.S. military thinking on the use of AI, Chinese military scholars appear to be reaching different conclusions. U.S. thinking tends to emphasize the role of AI in enhancing firepower- and maneuver-centric strategies. The PLA, on the other hand, is advancing AI concepts that enhance its information-centric military strategies*" (Dahm 2020). Referring to the fourth generation of strategic culture studies, we can place this situation in Bloomfield's conceptualization of strategic subcultures. For both the United States and China, these are one concerning a preference for AI application towards weapons and operation systems and one towards cyber and information strategies. As far as the United States is concerned, the strategic subculture that best answers to the tactical challenges identified by the country is the former, which therefore becomes the dominant one. Conversely, in the Chinese case it is the latter, which in turn becomes dominant.

Findings

Based on the aforementioned information, it can be stipulated that we are in the presence of two distinct AI-RMAs: the Chinese AI-RMA and the American AI-RMA. Whereas this can be an appropriate summarization of the current situation, it is crucial to stress that this differentiation does not undermine the previous argument on the existence of a more universal AI-RMA. As a matter of fact, the characterizing elements of this RMA can be found in both the Chinese and American ones, with the noteworthy difference that in both cases they can be more or less present depending on one country's preferences. However, these preferences do not impact the argumentation on the ongoing RMA being the AI-RMA, but simply reflect behaviors dictated by strategic cultures that appear to have a greater influence on this than on preceding RMAs.

As far as China is concerned, the previous analysis highlighted the importance that emerging technologies, chief amongst which AI in these days, are considered to bear in the field of military affairs, both by the Chinese political establishment as well as by the PLA. Although technology is held in high regard, it is worth stressing that its importance is only acknowledged as long as it is instrumental to the pursuing of the country's dominant strategic culture. A hierarchy can be found in how technology and strategic culture relate to one another in China, with its strategic culture dominating the scene, and technology being implemented with the specific objective of putting behaviors that facilitate said strategic culture into effect. Therefore, with China's preferred course of action being that of avoiding both striking enemy lines first and carrying out traditional military attacks, AI's implementation is strongly directed at information and cyber warfare. This strategy allows Beijing to defend itself from foreign confrontations, all the while providing the PLA with warfare structures that have the potential

of completely paralyzing the enemy's system of systems. In turn, this greatly reduces the necessity of carrying out more traditional military operations, including those that require the deployment of military personnel on foreign soil. Although these characteristics represent the main focus of China's approach toward the AI-RMA, these are not the only ones. As a matter of fact, the country is not rejecting the idea of dedicating resources to develop AWS as well. However, so far the priority appears to be focused on information and cyber warfare AI-enabled systems, as these better reflect Chinese strategic culture.

When it comes to the United States, the characteristics regarding its approach to the AI-RMA painted a fairly different picture of the situation. As with the previous case, strategic culture plays a vital role in how AI is implemented in the country's military affairs as well. However, here it can be seen that the U.S. course of action of choice is one that allows the country to swiftly and definitely defeat every level of the enemy through military operations, often on the ground. With this particular understanding of warfare in mind, the approach that appears to be the most sensible in regards to implementing AI in American military affairs is that mainly focused on firepower, military operations, and AWS. This line of action best fits the main features previously analyzed that merge into the broader understanding of the strategic culture of the country, from its overreliance on technology to its historic industrial approach to war. However, even in this case, Washington is not simply ignoring the potential that AI can have in regard to other sectors of military affairs, devoting resources towards the development of cyber and information warfare systems as well. Nevertheless, these are significantly less developed than AWS' programs are, for instance, and have witnessed a greater effort in their regards only recently.

When it comes to the AI-RMA, China and the United States' takes on the topic at hand appear to be diametrically opposed to one another. Bearing this in mind, it can still be stated that both countries, although to a different extent, present all the main characteristics that have previously been attributed to a more universalized AI-RMA. This is crucial, as it cements the idea of an actual AI-RMA that can be implemented by several countries, which will be characterized by countries' respective strategic cultures.

Possible developments of the AI-RMA in the future

The information illustrated in this chapter allows us to speculate on the future development of the AI-RMA. First, it can be expected that China and the United States will continue on the path they have followed so far, as the strategic culture that is behind said path is strongly rooted in these countries and not likely to change anytime soon. However, as more studies and literature are produced on the subject, Beijing and Washington may be inclined to devote more resources to those respective fields that have so far been less considered, as not to find themselves overly disadvantaged vis a vis one another.

Although this scenario appears to be the most plausible, at least for the years to come, it must be taken into consideration the possibility of strategic subcultures dethroning the dominant one as they no longer provide the appropriate response to possible newly established strategic environments, as described by the fourth generation of strategic culture scholars. In this instance, it is worth going back to the Chinese example. Interviewed on the subject of Chinese strategic culture, Christopher A. Ford makes a noteworthy contribution to the discussion. Chief legislative counsel for the U.S. Senate Foreign Relations Committee at the time of his declarations, he pictured the idea of a Chinese strategic culture as one centered around pacificism and the refusal of resorting to the use of force as an opportunistic stance by Beijing

(Ford 2016). Behind this smokescreen, Chinese strategic culture can be described as realpolitik, with the country having historically been willing to use force when the opportunity arises (Ibid.). Hence, there is an intricate balance between these two stances, with the former possibly being the dominant one solely because of the current international geopolitical situation. As, in a possible future, these conditions might change, so might the more offensive Chinese subculture become dominant, causing major shifts in the PLA's implementation of AI.

Conversely, in regards to the United States, recent findings stress an evolving feeling shared by American citizens and their military leadership regarding a growing aversion to sustaining casualties (Mahnken 2006). This idea fits naturally with the dominant strategic culture previously analyzed of making warfare as unmanned as possible, as this would allow withdrawing soldiers from dangerous situations. However, it could be argued that the use of AWS does not completely remove the possibility of casualties, as civilians could still fall victim to the effects of war. Further, if as previously stipulated AWS would contribute in broadening the battlefield, this could end up involving more individuals to the risk of becoming victims of war. If this American subculture focusing on preventing casualties was to become dominant, perhaps as the consequence of a drastic change in the political scene of the country or as the effect of a particularly severe military defeat, the U.S. could look at implementing AI in information and cyber warfare as the main answer to its new strategic culture.

Conclusion

This thesis has looked at whether AI can be considered the upcoming RMA. To understand AI's true potential, its effects on all three levels of war have been analyzed. This has made it possible to confidently demonstrate that, in all three cases, these effects are revolutionary. Hence, AI does have the potential to drastically impact military affairs and to cause a full-bloomed revolution. Alongside AI's technological potential, the cultural setting in which this technology is implemented appears to be equally crucial for a complete understanding of the topic at hand. Limiting our findings to the technological potential would result in an incomplete argument. For this reason, these findings need to be looked at together with the respective strategic cultures of those countries that, to this day, represent the leaders in the AI-RMA: China and the United States.

These two countries are the prominent powers in the development and application of the AI-RMA internationally. An analysis of their behaviors in regard to this concept has shown that strategic culture appears to be a crucial variable in how countries implement the AI-RMA in their military strategies. Whereas Beijing is mainly focusing on the development of instruments aimed at cyber and information warfare, Washington has been mostly focusing on the development of AI-enabled weapons and operation systems. For this reason, it appears that we are looking at two AI-RMAs: that of China and that of the United States. This, however, does not challenge the conceptualization of a more generic and universal understanding of the AI-RMA, as both countries are also focusing their efforts on the implementation of AI in the other country's field of choice. It can be safely stated, therefore, that a general understanding of the main features of the upcoming AI-RMA is possible, as long as this is paired with an understanding of countries' strategic cultures.

Finally, the analysis carried out throughout this thesis lends itself to possible speculations about the future development of the AI-RMA. We stipulated that the Chinese and American AI-RMAs as seen in this work will most likely keep their main characteristics, as these are rooted in respective strategic cultures that are not likely to change any time soon. However, it was also stipulated that possible shifts in strategic environments could cause strategic subcultures to take over the dominant ones in both the United States and China. This last scenario does not seem likely in the foreseeable future. However, recent studies and pieces of literature have proven that such an event is plausible. Still, for the time being, there appears to be no clear indication that would hint at the possibility of an imminent radical shift concerning the dominant strategic culture in either of these countries.

Notwithstanding whether such a change will or will not be witnessed, it can still be safely argued that both countries will proceed to increase their respective efforts in the implementation of those fields concerning specific areas of this RMA that are not their current choice of preference. This appears to be sensible, as it would represent a tactic to avoid being overly disadvantaged on certain fronts vis a vis the other main actor. Furthermore, as this field of study gains more attention, understanding which areas are being developed the most by the other main country is becoming incrementally easier. As a consequence, this could be met by Washington and Beijing's desire of preventing the other from establishing itself as the leading power in specific fields concerning the AI-RMA.

In regards to the role that China and the United States are currently playing in the development and implementation of the AI-RMA, one may wonder whether this supremacy will ever be challenged. As a matter of fact, despite these countries being the leading powers in this field as of now, other countries are closing the gap and showing interest in this RMA as well,

recognizing the critical military and strategic advantage it could bring. In doing so, these newcomers are implementing strategies aimed at raising their status in the field of the AI-RMA to match that of both the United States and China.

The aforementioned example of Russia, based on findings by Bendett et al., demonstrates this point. In this case, a parallel between Moscow and Beijing can be drawn, with Russia seemingly promoting the implementation of AI in its military affairs with the core goal of developing state of the art structures for cyber and information warfare. Specifically, AI technologies with these purposes are being perfected "*with a view to the disruption of Western command and control systems and communication facilities, as well as the establishment of information superiority*" (Bendett, Boulègue, Connolly, Konaev, Podvig Zysk 2021). Much like both China and the United States, Russia as well is not limiting its interest to only one field of the AI-RMA, with the country being recognized as the most defiant supporter of AWS (Haner Garcia 2019). The Kremlin's enthusiasm regarding the potential of the application of AI to its military affairs is perfectly expressed by a statement pronounced by the President of Russia Vladimir Putin, who stated that the "*country that will dominate the Artificial Intelligence (AI) will lead the world* [and that] *Russia wants to be a leader in the field*" (Dobrescu Dobrescu 2018). Notwithstanding the enthusiastic view that the country has in regards to AI, it appears extremely clear that Russia is dramatically lacking in the field of the AI-RMA vis a vis China and the United States. So much so that Western experts are skeptical about the country's true potential concerning the subject at hand. There are several reasons for this, which span from Russia's weak economic investments in researching and developing these technologies, to its lackluster academic work being produced on the topic, and to the country's reliance on foreign powers for crucial components necessary for AI systems to function properly (Bendett, Boulègue, Connolly, Konaev, Podvig Zysk 2021 ; Konaev Dunham

2020). Consequently, Russia does not yet appear as a plausible rival to China and the U.S. when it comes to the AI-RMA.

In the international arena, another actor has shown great interest in emerging technologies linked to AI: the European Union (EU). With both significant economic and military resources, the EU arguably has the potential to establish itself as a leading power in the field of AI, specifically in that of AWS, alongside its American and Chinese counterparts (Haner Garcia 2019). However, as of today, this is not the case. There are several reasons that can explain this situation, chief amongst which are the mixed feelings expressed so far by member states of the EU regarding the application of AI to the military affairs of the Union (Franke Sartori 2019). Whereas an important progress in the fields of industrial AI and robotics can be witnessed within the borders of the EU, the same cannot be said about the field of AI and military affairs. With certain member states actively developing AI military systems for their respective national interests, others, such as Austria, have rejected this view, stressing the need for a ban on AWS (Haner Garcia 2019). Further, even amongst those member states that are developing these systems, some (such as Germany and Italy) are deciding to put them aside in order to favor other sectors that can benefit from AI like the economic one. France is a noteworthy exception to this phenomenon, as it has shown great interest in the development and prioritization of AI military systems. (Franke Sartori 2019).

Despite possessing the necessary means to close the gap that currently exists between the EU on one side and China and the United States on the other, without a strong and common policy developed by Brussels on how to approach the AI-RMA, EU members are bound to be left behind in the field of the AI-RMA.

In addition to these two examples, others such as India, Japan, and Israel would be worth looking into (Haner 2019). However, findings in this regard would not be much different from those reached in regards to Russia and the EU, with these nations currently not representing worthy competitors to China and the United States: compared to them, India, Japan, and Israel's approaches towards the AI-RMA are still in their infancy (Ibid. ; Frantzman 2021). With the right precautions, and taking into account the inevitable differences between all of these actors, it can be concluded that China and the United States represent so far the two leading powers in regards to the AI-RMA.

This phenomenon, however, allows this thesis to make yet another prediction in regards to the future of the AI-RMA: as an increasing number of countries approaches and shows interest in the AI-RMA, an international competitivity aimed at granting one's country the place of the leading power in this field is to be expected. As more and more approach the rivalry over the dominance of the AI-RMA that so far has mainly concerned two nations, an increase in the efforts put into this by interested states will arguably follow. In turn, this would allow technological breakthroughs that, we stipulate, will result in those more 'futuristic' consequences of the AI-RMA that were discussed in the previous chapter. Consequently, we can expect a revolutionary turn in how military affairs are conceived, with much of the current 'way of war' becoming obsolete, allowing certain countries to move towards a new dimension of how war is thought of and fought out. Further, what can be seen as an 'internationalization' regarding the approach to the AI-RMA by a growing number of countries and intragovernmental organizations further cements the idea of a universal AI-RMA, since its elements and consequences can be potentially found in more than simply China and the United States. As it was the case before, respective strategic cultures are to be seen as crucial in how these countries will approach and implement the AI-RMA.

By and large, AI can now be considered the upcoming RMA. With the initial phases of this phenomenon already present nowadays, the technological potential AI bears, alongside the influence that different strategic cultures will have on its approach, has the revolutionary and pervasive effects that need to be present for an RMA to be identified as such. For these reasons, the future of military affairs should be expected to go through a drastic transformative phase, which will significantly change the understanding of war. The in-depth analysis that has been carried out throughout this project allows us to confidently state these previous points. Further, it proves that China and the United States are the two leading powers in the AI-RMA. Although other countries are now trying to claim a place in the AI-RMA, the Chinese and American supremacy still appears strong and unchallengeable.

Bibliography

ADAMS, R. L, 2017, 10 Powerful Examples Of Artificial Intelligence In Use Today. *Forbes* [online]. 2017. Available from: https://www.forbes.com/sites/robertadams/2017/01/10/10-powerful-examples-of-artificial-intelligence-in-use-today/?sh=73c29b80420d

ADAMS, STEPHEN T., 1986, Artificial intelligence, culture, and individual responsibility. *Technology in Society*. 1986. Vol. 8, no. 4, p. 251-257. DOI 10.1016/0160-791x(86)90014-x. Elsevier BV

ADAMSKY, DIMA, 2010, *The Culture of Military Innovation: The Impact of Cultural Factors on the Revolution in Military Affairs in Russia, the US, and Israel*. Stanford, California : Stanford University Press.

ADAMSKY, DIMA and BJERGA, KJELL INGE, 2010, Introduction to the Information-Technology Revolution in Military Affairs. *Journal of Strategic Studies*. 2010. Vol. 33, no. 4, p. 463-468. DOI 10.1080/01402390.2010.489700. Informa UK Limited

AGRAWAL, AJAY, GANS, JOSHUA S and GOLDFARB, AVI, 2017, What to Expect From Artificial Intelligence. *MIT Sloan Management Review*. 2017.

ALI, ATIF, SHEHZAD, KHURRAM, FARID, ZULQARNAIN and FAROOQ, MUHAMMAD UMAR, 2021, Artificial Intelligence Potential Trends in Military. *Foundation University Journal of Engineering and Applied Sciences*. 2021. Vol. 2, no. 1.

ALLISON, GRAHAM, 2019, Is China Beating America to AI Supremacy?. *The National Interest* [online]. 2019. Available from: https://nationalinterest.org/feature/china-beating-america-ai-supremacy-106861

ALLYN, BOBBY, 2022, Deepfake video of Zelenskyy could be 'tip of the iceberg' in info war, experts warn. *Npr.org* [online]. 2022. Available from: https://www.npr.org/2022/03/16/1087062648/deepfake-video-zelenskyy-experts-war-manipulation-ukraine-russia?t=1650959439358

ASIMOV, ISAAC, 1950, *I, Robot*. United States : Gnome Press.

BATEMAN, ROBERT, 2015, Understanding Military Strategy and the Four Levels of War. *Esquire* [online]. 2015. Available from: https://www.esquire.com/news-politics/politics/news/a39985/four-levels-of-war/

BEAVERS, ANTHONY, 2013. Alan Turing: Mathematical mechanist. *Cooper, S. Barry; van Leeuwen, Jan. Alan Turing: His Work and Impact. Waltham: Elsevier*, 2013, 481-485.

BECCHI, GIACOMO and SHALEVA, IRENA, 2021, How Artificial Intelligence will inevitably affect tomorrow's balance of power - MSOI thePost. *MSOI thePost* [online]. 2021. Available from: https://www.msoithepost.org/2021/04/04/how-artificial-intelligence-will-inevitably-affect-tomorrows-balance-of-power/

BENDETT, SAMUEL, BOULÈGUE, MATHIEU, CONNOLLY, RICHARD, KONAEV, MARGARITA, PODVIG, PAVEL and ZYSK, KATARZYNA, 2021, Advanced military technology in Russia. *Chatham House – International Affairs Think Tank* [online]. 2021. Available from: https://www.chathamhouse.org/2021/09/advanced-military-technology-russia

BENSAID, ADAM, 2021, Israel's autonomous 'robo-snipers' and suicide drones raise ethical dilemma. *TRTWORLD.com* [online]. 2021. Available from: https://www.trtworld.com/magazine/israel-s-autonomous-robo-snipers-and-suicide-drones-raise-ethical-dilemma-44557

BLAKEMORE, ERIN, 2020, How the advent of nuclear weapons changed the course of history. *National Geographic* [online]. 2020. Available from: https://www.nationalgeographic.com/history/article/how-advent-nuclear-weapons-changed-history

BLASKO, DENNIS J., 2011, 'Technology Determines Tactics': The Relationship between Technology and Doctrine in Chinese Military Thinking. *Journal of Strategic Studies*. 2011. Vol. 34, no. 3, p. 355-381. DOI 10.1080/01402390.2011.574979. Informa UK Limited

BLOOMFIELD, ALAN, 2012, Time to Move On: Reconceptualizing the Strategic Culture Debate. *Contemporary Security Policy*. 2012. Vol. 33, no. 3, p. 437-461. DOI 10.1080/13523260.2012.727679. Informa UK Limited

BUCHANAN, BEN, BANSEMER, JOHN, CARY, DAKOTA, LUCAS, JACK and MUSSER, MICAH, 2020, Automating Cyber Attacks: Hype and Reality. *Center for Security and Emerging Technology*. 2020. P. 10. DOI 10.51593/2020ca002. Center for Security and Emerging Technology

CARON, JEAN-FRANÇOIS, 2020, Defining semi-autonomous, automated and autonomous weapon systems in order to understand their ethical challenges. *Digital War*. 2020. Vol. 1, no. 1-3, p. 173-177. DOI 10.1057/s42984-020-00028-5. Springer Science and Business Media LLC

CHAPMAN, GARY, 2003, An Introduction to the Revolution in Military Affairs. In : *XV Amaldi Conference on Problems in Global Security*. 2003.

COHEN, ELIOT A., 1996, A Revolution in Warfare. *Foreign Affairs*. 1996. Vol. 75, no. 2, p. 37. DOI 10.2307/20047487. JSTOR

CLAUSEWITZ, CARL VON, HOWARD, MICHAEL, PARET, PETER and BRODIE, BERNARD, 1984, *On war*. Princeton : Princeton University Press.

CRAWFORD, EMILY, 2011, Levée En Masse – A Nineteenth Century Concept in a Twenty-First Century World. *Sidney Law School Research Paper No. 11/31*. 2011.

DAHM, MICHAEL, 2020, Chinese Debates on the Military Utility of Artificial Intelligence - War on the Rocks. *War on the Rocks* [online]. 2020. Available from: https://warontherocks.com/2020/06/chinese-debates-on-the-military-utility-of-artificial-intelligence/

DAHMANN, JUDITH S. Systems of systems characterization and types. *Systems of Systems Engineering for NATO Defence Applications (STO-EN-SCI-276)*, 2015, 1-14.

DARBY, CHRISTOPHER and SEWALL, SARAH, 2021, The Innovation Wars. *Foreign Affairs* [online]. 2021. Available from: https://www.foreignaffairs.com/articles/united-states/2021-02-10/technology-innovation-wars

DE VYNCK, GERRIT, 2021, The U.S. says humans will always be in control of AI weapons. But the age of autonomous war is already here. *washingtonpost.com* [online]. 2021. Available from: https://www.washingtonpost.com/technology/2021/07/07/ai-weapons-us-military/

DINIC, LEONARDO, 2022, Artificial Intelligence and the China-U.S. Rivalry. *China-US Focus* [online]. 2022. Available from: https://www.chinausfocus.com/peace-security/artificial-intelligence-and-the-china-us-rivalry

DOBRESCU, EDITH MIHAELA and DOBRESCU, EMILIAN M, 2018, Artificial intelligence (Ai)-the technology that shapes the world. *Global Economic Observer*. 2018. Vol. 6, no. 2, p. 71-81.

DOBREV, DIMITER, 2004, A Definition of Artificial Intelligence. *Institute of Mathematics and Informatics Bulgarian Academy of Sciences*. 2004.

DOMONOSKE, CAMILA, 2021, Cars are getting better at driving themselves, but you still can't sit back and nap. *Npr.org* [online]. 2021. Available from: https://www.npr.org/2021/12/22/1064598337/cars-are-getting-better-at-driving-themselves-but-you-still-cant-sit-back-and-na?t=1647942236908

DOURISH, PAUL, 2016, Algorithms and their others: Algorithmic culture in context. *Big Data & Society*. 2016. Vol. 3, no. 2, p. 205395171666512. DOI 10.1177/2053951716665128. SAGE Publications

ECHEVARRIA, ANTULIO J, 2013, Strategic Culture: More Problems than Prospects. *Infinite Journal*. 2013. Vol. 3, no. 2, p. 4-7.

ENGLER, ALEX, 2019, Fighting deepfakes when detection fails. *Brookings* [online]. 2019. Available from: https://www.brookings.edu/research/fighting-deepfakes-when-detection-fails/

ETZIONI, AMITAI and ETZIONI, OREN, 2017, Pros and Cons of Autonomous Weapons Systems. *Military Review*. 2017.

FARRELL, THEO, 1998, Culture and military power [Reviewed Works: Strategic Cultures in the Asia-Pacific Region by Ken Booth, Russell Trood; Cultural Realism: Strategic Culture

and Grand Strategy in Chinese History by Alastair Iain Johnston; Cultural Norms and National Security: Police and Military in Postwar Japan by Peter J. Katzenstein; The Culture of National Security: Norms and Identity in World Politics by Peter J. Katzenstein; Imagining War: French and British Military Doctrine between the Wars by Elizabeth Kier]. *Review of International Studies*. 1998. Vol. 24, no. 3, p. 407-416.

FAZEKAS, FERENC, 2021, AI and Military Operations' Planning. *Artificial Intelligence and Its Contexts*. 2021. P. 79-91. DOI 10.1007/978-3-030-88972-2_6. Springer International Publishing

FORD, CHRISTOPHER A, 2016, *Behind the Official Narrative - China's Strategic Culture in Perspective*. [in person]. 2016.

FRANCIS, DAVID, 2013, How a New Army of Robots Can Cut the Defense Budget. *The Fiscal Times* [online]. 2013. Available from: https://www.thefiscaltimes.com/Articles/2013/04/02/How-a-New-Army-of-Robots-Can-Cut-the-Defense-Budget

FRANKE, ULRIKE and SARTORI, PAOLA, 2019, MACHINE POLITICS: EUROPE AND THE AI REVOLUTION. *European Council on Foreign Relations*. 2019.

FRANTZMAN, SETH J, 2021, Israel pushes military digital transformation in the age of 'artificial intelligence war'. *c4isrnet.com* [online]. 2021. Available from: https://www.c4isrnet.com/battlefield-tech/it-networks/2021/07/23/israel-pushes-military-digital-transformation-in-the-age-of-artificial-intelligence-war/

FROELICH, PAULA, 2021, Killer drone 'hunted down a human target' without being told to. *Nypost.com* [online]. 2021. Available from: https://nypost.com/2021/05/29/killer-drone-hunted-down-a-human-target-without-being-told-to/

FRY, MICHAEL G, GOLDSTEIN, ERIK and LANGHORNE, RICHARD, 2002, *Guide to international relations and diplomacy*. London : Bloomsbury Academic.

GAMMERMAN, ALEXANDER and VOVK, VLADIMIR, 2007, Hedging Predictions in Machine Learning. *The Computer Journal*. 2007. Vol. 50, no. 2, p. 151-163. DOI 10.1093/comjnl/bxl065. Oxford University Press (OUP)

GARFINKEL, BEN and DAFOE, ALLAN, 2019, Artificial Intelligence, Foresight, and the Offense-Defense Balance - War on the Rocks. *War on the Rocks*[online]. 2019. Available from: https://warontherocks.com/2019/12/artificial-intelligence-foresight-and-the-offense-defense-balance/

GRAY, COLIN S., 1981, National Style in Strategy: The American Example. *International Security*. 1981. Vol. 6, no. 2, p. 21. DOI 10.2307/2538645. JSTOR

GRONLUND, KIRSTEN, 2019, State of AI: Artificial Intelligence, the Military and Increasingly Autonomous Weapons - Future of Life Institute. *Future of Life Institute* [online]. 2019. Available from: https://futureoflife.org/2019/05/09/state-of-ai/

GUYER, JONATHAN, 2022, The Ukraine war shows the limits of US power. *Vox* [online]. 2022. Available from: https://www.vox.com/22951264/russia-ukraine-war-american-superpower-limits

HANER, JUSTIN, 2019, Dark Horses in the Lethal AI Arms Race A Research Supplement to "The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development" in Global Policy. 2019.

HANER, JUSTIN and GARCIA, DENISE, 2019, The Artificial Intelligence Arms Race: Trends and World Leaders in Autonomous Weapons Development. *Global Policy*. 2019. Vol. 10, no. 3, p. 331-337. DOI 10.1111/1758-5899.12713. Wiley

HARB, ALI, 2022, Russia-Ukraine: What is a no-fly zone and why has NATO said no?. *Aljazeera.com* [online]. 2022. Available from: https://www.aljazeera.com/news/2022/3/7/russia-ukraine-what-is-no-fly-zone-why-has-nato-said-no

HOROWITZ, JENN HENRY, 2020, Is Alexa an AI?. *itchronicles.com*[online]. 2020. [Accessed 26 April 2022]. Available from: https://itchronicles.com/artificial-intelligence/is-alexa-an-ai/

IJEBOR, COLIN, 2020, Artificially Intelligent Warfare and the Revolution in Military Affairs. [online]. 2020. Available from: https://mspace.lib.umanitoba.ca/handle/1993/35169

JERVIS, ROBERT, 1978, Cooperation under the Security Dilemma. *World Politics*. 1978. Vol. 30, no. 2, p. 167-214. DOI 10.2307/2009958. Cambridge University Press (CUP)

JOHNSON, BONNIE and TREADWAY, WILLIAM A., 2019, Artificial Intelligence — An Enabler of Naval Tactical Decision Superiority. *AI Magazine*. 2019. Vol. 40, no. 1, p. 63-78. DOI 10.1609/aimag.v40i1.2852. Association for the Advancement of Artificial Intelligence (AAAI)

JOHNSON, JAMES, 2019, Artificial intelligence & future warfare: implications for international security. *Defense & Security Analysis*. 2019. Vol. 35, no. 2, p. 147-169. DOI 10.1080/14751798.2019.1600800. Informa UK Limited

JOHNSON, JEANNIE L, 2020, Fit for Future Conflict? American Strategic Culture in the Context of Great Power Competition. *Journal of Advanced Military Studies*. 2020. Vol. 11, no. 1, p. 185-208.

JOHNSON, STEPHEN, 2022, The Turing test: AI still hasn't passed the "imitation game". *Big Think* [online]. 2022. Available from: https://bigthink.com/the-future/turing-test-imitation-game/

JOHNSTON, ALASTAIR IAIN, 1995, Thinking about Strategic Culture. *International Security*. 1995. Vol. 19, no. 4, p. 32. DOI 10.2307/2539119. JSTOR

JUNG, GIA, 2018, Our AI overlord: the cultural persistence of Isaac Asimov's three laws of robotics in understanding artificial intelligence. *Emergence* [online]. 2018. Available from:

https://emergencejournal.english.ucsb.edu/index.php/2018/06/05/our-ai-overlord-the-cultural-persistence-of-isaac-asimovs-three-laws-of-robotics-in-understanding-artificial-intelligence/

KANIA, ELSA B., 2021, Artificial intelligence in China's revolution in military affairs. *Journal of Strategic Studies*. 2021. P. 1-28. DOI 10.1080/01402390.2021.1894136. Informa UK Limited

KIER, ELIZABETH, 1997, *Imagining War: French and British Military Doctrine between the Wars*. Princeton Studies in International History and Politics.

KLEIN, BRADLEY S., 1988, Hegemony and strategic culture: American power projection and alliance defence politics. *Review of International Studies*. 1988. Vol. 14, no. 2, p. 133-148.

KONAEV, MARGARITA and DUNHAM, JAMES, 2020, Russian AI Research 2010-2018. *Center for Security and Emerging Technology*. 2020. DOI 10.51593/20200040. Center for Security and Emerging Technology

KOVIC, MARKO, 2018, The strategic paradox of autonomous weapons. *Zurich Institute of Public Affairs Research*. 2018.

KREPINEVICH, ANDREW F, 1994, Cavalry to computer; the pattern of military revolutions. *The National Interest*. 1994. Vol. 37.

KRISTENSEN, HANS M. and NORRIS, ROBERT S., 2013, Global nuclear weapons inventories, 1945–2013. *Bulletin of the Atomic Scientists*. 2013. Vol. 69, no. 5, p. 75-81. DOI 10.1177/0096340213501363. Informa UK Limited

LANTIS, JEFFREY S, 2006, Strategic Culture: From Clausewitz To Constructivism. *Strategic Culture and Weapons of Mass Destruction*. 2006. P. 33-52.

LAZARO, OLIVIA, 2018, *Artificial Intelligence and the Future of Operational Art* [online]. Fort Leavenworth, KS : School of Advanced Military Studies US Army Command and General Staff College. Available from: https://www.hsdl.org/?view&did=824292

LEONARD, MATT, 2020, Spending on robotics forecast to exceed $112B in 2020: IDC. *Supply Chain Dive* [online]. 2020. Available from: https://www.supplychaindive.com/news/spending-on-robotics-forecast-to-exceed-112b-in-2020-idc/570323/

LIPPMANN, WALTER, 1952, *Isolation and alliances*. Boston : Little, Brown and Co.

LOCK, EDWARD, 2017, Strategic Culture Theory: What, Why, and How. *Oxford Research Encyclopedia of Politics*. 2017. DOI 10.1093/acrefore/9780190228637.013.320. Oxford University Press

LONGHURST, KERRY, 2018, On strategic culture. *Germany and the use of force*. 2018. DOI 10.7765/97815261374O1.00005. Manchester University Press

LOWENSOHN, JOSH, 2014, This is Tesla's D: an all-wheel-drive Model S with 'autopilot'. *The Verge* [online]. 2014. Available from: https://www.theverge.com/2014/10/9/6955357/this-is-tesla-s-d-an-all-wheel-drive-car-with-eyes-on-the-road

LUNGU, ANDREI, 2021, The U.S.-China Clash Is About Ideology After All. *Foreign Policy* [online]. 2021. Available from: https://foreignpolicy.com/2021/04/06/us-china-ideology-communism-capitalism/

LUTTWAK, EDWARD N., 1980, The Operational Level of War. *International Security*. 1980. Vol. 5, no. 3, p. 61. DOI 10.2307/2538420. JSTOR

MAKAROV, ALEXEY, 2020, Council Post: Why Are We Still Far Away From An AI-Based Society?. *Forbes* [online]. 2020. Available from: https://www.forbes.com/sites/forbestechcouncil/2020/05/05/why-are-we-still-far-away-from-an-ai-based-society/

MAHESH, BATTA, 2020, Machine Learning Algorithms - A Review. *International Journal of Science and Research (IJSR)*. 2020. Vol. 9, no. 1.

MAHNKEN, THOMAS G, 2006, *United States Strategic Culture*. Defense Threat Reduction Agency Advanced Systems and Concepts Office. Comparative Strategic Cultures Curriculum.

MALONEY, SEAN M. and ROBERTSON, SCOT, 1999, The Revolution in Military Affairs: Possible Implications for Canada. *International Journal*. 1999. Vol. 54, no. 3, p. 443. DOI 10.2307/40203405. SAGE Publications

MCINNIS, KATHLEEN J, 2020, The Competitive Advantages and Risks of Alliances. *The Heritage Foundation* [online]. 2020. Available from: https://www.heritage.org/military-strength-essays/2020-essays/the-competitive-advantages-and-risks-alliances

MCKENDRICK, KATHLEEN, 2017, *The Application of Artificial Intelligence in Operations Planning*.

MENAND, LOUIS, 2018, What Went Wrong in Vietnam. *The New Yorker* [online]. 2018. Available from: https://www.newyorker.com/magazine/2018/02/26/what-went-wrong-in-vietnam

METZ, STEVEN and KIEVIT, JAMES, 1995, Strategy And The Revolution In Military Affairs: From Theory To Policy. *Strategic Studies Institute, US Army War College*. 1995.

MILLER, JACOB H, 2014, Strategic Culture as the Basis for Military Adaptive Capacity: Overcoming battlefifield technological surprises. *CUREJ: College Undergraduate Research Electronic Journal, University of Pennsylvania*. 2014.

MILMO, DAN, 2021, Apple aims to launch self-driving electric car in 2025, says report. *the Guardian* [online]. 2021. Available from: https://www.theguardian.com/technology/2021/nov/18/apple-aims-to-launch-self-driving-electric-car-in-2025-says-report

MORGAN, FORREST E, BOUDREAUX, BENJAMIN, LOHN, ANDREW J, ASHBY, MARK, CURRIDEN, CHRISTIAN, KLIMA, KELLY and GROSSMAN, DEREK, 2020, *Military Applications of Artificial Intelligence: Ethical Concerns in an Uncertain World*. Santa Monica, Calif. : RAND Corporation.

MOUSAVIZADEH, ALEXANDRA, MEHTA, BIJAL and DARRAH, KIM, 2021, AI Boom Time. *Tortoise* [online]. 2021. Available from: https://www.tortoisemedia.com/2021/12/02/ai-boom-time/

MURRAY, WILLIAMSON, 1997, Thinking About Revolutions in Military Affairs. *Joint Force Quarterly*. 1997.

MURRAY, WILLIAMSON, 1999, Does military culture matter?. *Orbis*. 1999. Vol. 43, no. 1, p. 27-42. DOI 10.1016/s0030-4387(99)80055-6. Elsevier BV

NEUNECK, GÖTZ, 2008, The revolution in military affairs: Its driving forces, elements, and complexity. *Complexity*. 2008. Vol. 14, no. 1, p. 50-61. DOI 10.1002/cplx.20236. Wiley

NOËL, JACK, 2011, *FINABEL: contributing to European army interoperability since 1953*. Brussels : Permanent Secretariat of the FINABEL Committee.

NYE, JOSEPH S. and LYNN-JONES, SEAN M., 1988, International Security Studies: A Report of a Conference on the State of the Field. *International Security*. 1988. Vol. 12, no. 4, p. 5. DOI 10.2307/2538992. JSTOR

O'NEILL, PATRICK HOWELL, 2020, The world's top deepfake artist: 'Wow, this is developing more rapidly than I thought.'. *MIT Technology Review*[online]. 2020. Available from: https://www.technologyreview.com/2019/09/18/132961/the-worlds-top-deepfake-artist-wow-this-is-developing-more-rapidly-than-i-thought/

OVERY, RICHARD, 2006, *Why the allies won*. London : Pimlico.

PAYNE, KENNETH, 2018, Artificial Intelligence: A Revolution in Strategic Affairs?. *Survival*. 2018. Vol. 60, no. 5, p. 7-32. DOI 10.1080/00396338.2018.1518374. Informa UK Limited

PEREIRA MENDES, LEANDRO, 2021, Artificial Intelligence in the Military. *Finabel.org* [online]. 2021. Available from: https://finabel.org/artificial-intelligence-in-the-military/

PETRELLA, STEPHANIE, MILLER, CHRIS and COOPER, BENJAMIN, 2021, Russia's Artificial Intelligence Strategy: The Role of State-Owned Firms. *Orbis*. 2021. Vol. 65, no. 1, p. 75-100. DOI 10.1016/j.orbis.2020.11.004. Elsevier BV

PHAM, LISA, 2009, Hey, Big Spender, You Want Value?. *Nytimes.com* [online]. 2009. Available from: https://www.nytimes.com/2009/10/24/business/global/24concierge.html

PIPER, KELSEY, 2020, It's 2020. Where are our self-driving cars?. *Vox* [online]. 2020. Available from: https://www.vox.com/future-perfect/2020/2/14/21063487/self-driving-cars-autonomous-vehicles-waymo-cruise-uber

POMERLEAU, MARK, 2020, Pentagon AI team sets sights on information warfare. *C4ISRNET* [online]. 2020. Available from: https://www.c4isrnet.com/smr/information-warfare/2020/07/22/pentagon-ai-team-sets-sights-on-information-warfare/

RASKA, MICHAEL, 2020, The sixth RMA wave: Disruption in Military Affairs?. *Journal of Strategic Studies*. 2020. P. 1-24. DOI 10.1080/01402390.2020.1848818. Informa UK Limited

ROMANIUK, SCOTT NICHOLAS, 2017, Military Strategy and the Three Levels of Warfare. *Defencereport.com* [online]. 2017. [Accessed 30 March 2022]. Available from: https://defencereport.com/wp-content/uploads/2017/11/Romaniuk-Military-Strategy-and-the-Three-Levels-of-Warfare.pdf

ROSEN, STEPHEN PETER, 2010, The Impact of the Office of Net Assessment on the American Military in the Matter of the Revolution in Military Affairs. *Journal of Strategic Studies*. 2010. Vol. 33, no. 4, p. 469-482. DOI 10.1080/01402390.2010.489704. Informa UK Limited

RYAN, MISSY, 2021, The U.S. system created the world's most advanced military. Can it maintain an edge?. *The Washington Post* [online]. 2021. Available from: https://www.washingtonpost.com/national-security/china-us-military-technology/2021/03/31/acc2d9f4-866c-11eb-8a67-f314e5fcf88d_story.html

SANDER, ALISON and WOLFGANG, MELDON, 2014, The Rise of Robotics. *BCG Global* [online]. 2014. Available from: https://www.bcg.com/publications/2014/business-unit-strategy-innovation-rise-of-robotics

SCHNEIER, BRUCE, 2019, Machine Learning to Detect Software Vulnerabilities. *Schneier on Security* [online]. 2019. Available from: https://www.schneier.com/blog/archives/2019/01/machine_learnin.html

SHACHTMAN, NOAH, 2007, Robo-Snipers, "Auto Kill Zones" to Protect Israeli Borders. *Wired* [online]. 2007. Available from: https://www.wired.com/2007/06/for-years-and-y/

SHEAD, SAM, 2021, Amazon's Alexa assistant told a child to do a potentially lethal challenge. *cnbc.com* [online]. 2021. Available from: https://www.cnbc.com/2021/12/29/amazons-alexa-told-a-child-to-do-a-potentially-lethal-challenge.html

SIROTA, SARA, 2022, How Does a Conventional War Become Nuclear?. *The Intercept* [online]. 2022. Available from: https://theintercept.com/2022/03/11/nuclear-war-russia-ukraine-invasion-putin-biden/

SLOAN, ELINOR C, 2009, *The revolution in military affairs*. Montreal : McGill-Queen's University Press.

SOLOVYEVA, ANZHELIKA and HYNEK, NIK, 2018, Going beyond the "killer robots" debate: Six Dilemmas Autonomous Weapon Systems Raise. *Central European Journal of International and Security Studies*. 2018. Vol. 12, no. 3, p. 166-209.

STANKIEWICZ, KEVIN, 2020, 'Perfectly real' deepfakes will arrive in 6 months to a year, technology pioneer Hao Li says. *cnbc.com* [online]. 2020. Available from: https://www.cnbc.com/2019/09/20/hao-li-perfectly-real-deepfakes-will-arrive-in-6-months-to-a-year.html

STEFANICK, TOM, 2020, Why the AI revolution hasn't swept the military. *Brookings* [online]. 2020. Available from: https://www.brookings.edu/techstream/why-the-ai-revolution-hasnt-swept-the-military/

STOKES, SUSAN C., 2011, Political Clientelism. *Oxford Handbooks Online*. 2011. DOI 10.1093/oxfordhb/9780199604456.013.0031. Oxford University Press

SUKHANKIN, SERGEY, 2017, Russia Introduces EW Spetsnaz to Western Military District. *Eurasia Daily Monitor*. 2017. Vol. 14, no. 143.

SUKMAN, DANIEL, 2016, The Institutional Level of War. *The Strategy Bridge* [online]. 2016. Available from: https://thestrategybridge.org/the-bridge/2016/5/5/the-institutional-level-of-war

SULLIVAN, MARK, 2021, The U.S. is alarmingly close to an autonomous weapons arms race. *Fast Company* [online]. 2021. Available from: https://www.fastcompany.com/90640573/autonomous-weapons-war

SULLIVAN, RYAN, 2021, *The U.S., China, and artificial intelligence competition factors*. China Aerospace Studies Institute.

SZCZEPAŃSKI, MARCIN, 2019, *Economic impacts of artificial intelligence (AI)*. EPRS | European Parliamentary Research Service.

SZYMKOWSKI, SEAN, 2021, Microsoft and Volkswagen will collaborate on self-driving car software. *Roadshow* [online]. 2021. Available from: https://www.cnet.com/roadshow/news/microsoft-volkswagen-self-driving-car-software/

TAI, MICHAEL CHENG-TEK, 2020, The impact of artificial intelligence on human society and bioethics. *Tzu Chi Medical Journal*. 2020. Vol. 32, no. 4, p. 339. DOI 10.4103/tcmj.tcmj_71_20. Medknow

TARIQ, MUHAMMAD USMAN, POULIN, MARC and ABONAMAH, ABDULLAH A., 2021, Achieving Operational Excellence Through Artificial Intelligence: Driving Forces and Barriers. *Frontiers in Psychology*. 2021. Vol. 12. DOI 10.3389/fpsyg.2021.686624. Frontiers Media SA

TOFFLER, ALVIN and TOFFLER, HEIDI, 1994, *War and anti-war*. London : Warner Books.

TOON, OWEN B., ROBOCK, ALAN and TURCO, RICHARD P., 2008, Environmental consequences of nuclear war. *Physics Today*. 2008. Vol. 61, no. 12, p. 37-42. DOI 10.1063/1.3047679. AIP Publishing

TURING, ALAN M, 1950, I.—COMPUTING MACHINERY AND INTELLIGENCE. *Mind*. 1950. Vol. LIX, no. 236, p. 433-460. DOI 10.1093/mind/lix.236.433. Oxford University Press (OUP)

UZ ZAMAN, RASHED, 2009, Strategic Culture: A "Cultural" Understanding of War. *Comparative Strategy*. 2009. Vol. 28, no. 1, p. 68-88. DOI 10.1080/01495930802679785. Informa UK Limited

V, ANAND, 2020, Revisiting the Discourse on Strategic Culture: An Assessment of the Conceptual Debates. Strategic Analysis. 2020. Vol. 44, no. 3, p. 193-207.

VALORI, GIANCARLO ELIA, 2022, The development of warfare cyberspace in the United States of America – Part III. *IsraelDefense* [online]. 2022. Available from: https://www.israeldefense.co.il/en/node/54142

VAN ATTA, RICHARD H, DEITCHMAN, SEYMOUR J and REED, SIDNEY G, 1991, *DARPA Technical Accomplishments. Volume 3. An Overall Perspective and Assessment of the Technical Accomplishments of the Defense Advanced Research Projects Agency: 1958-1990*. Alexandria, Virginia : Institute for Defense Analysis.

VELEZ-GREEN, ALEXANDER, 2015, The Foreign Policy Essay: The South Korean Sentry—A "Killer Robot" to Prevent War. *Lawfare* [online]. 2015. Available from: https://www.lawfareblog.com/foreign-policy-essay-south-korean-sentry—-killer-robot-prevent-war

V K, ANIRUDH, 2022, How Does Artificial Intelligence Learn Through Machine Learning Algorithms?. *Toolbox.com* [online]. 2022. Available from: https://www.toolbox.com/tech/artificial-intelligence/articles/how-does-ai-learn-through-ml-algorithms/

WESTERLUND, MIKA, 2019, The Emergence of Deepfake Technology: A Review. *Technology Innovation Management Review*. 2019. Vol. 9, no. 11, p. 39-52.

WALDROP, MITCH, 2012, DARPA and the Internet Revolution. *DARPA* [online]. 2012. Available from: https://www.darpa.mil/attachments/(2O15)%20Global%20Nav%20-%20About%20Us%20-%20History%20-%20Resources%20-%2050th%20-%20Internet%20(Approved).pdf

WOLFSON, RICHARD and DALNOKI-VERESS, FERENC, 2022, The Devastating Effects of Nuclear Weapons. *The Wire Science*. 2022.

ZUIDERVEEN BORGESIUS, FREDERIK J, 2018, *Discrimination, artificial intelligence, and algorithmic decision-making*. Strasbourg: Council of Europe, Directorate General of Democracy.