

## **Weaponizing Energy: Anthropological Approach to Future of War**

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### **Abstract**

This thesis intends to offer an explanation to the evolution of war along technological developments mainly focusing in laser systems. The anthropological discussion of the study is based on Actor-Network Theory revealing the interaction among human and non-human participants of war network. Laser weapon systems are explained supported by the literature search, fieldwork, and interviews. The study seeks to demonstrate an alternative future perception of war with the integration of laser systems.

The redefined character of war can be described as laser-integrated flexible network with human actors and non-human actants on a whole engagement spectrum, across all domains, and all phases of conflicts with tactical and strategic implications on battlespace. While human actors are still the main decision-makers in war network, human wisdom is critically important more than ever.

### **Keywords**

War anthropology; actor-network theory; laser weapon systems; future war

## INTRODUCTION

In his conspicuous article "Energy and the Evolution of Culture," anthropologist, Leslie A. White (1943), claims cultural evolution has been fostered by the products human beings have produced with the tools they have invented using the energy harnessed from various sources. Along a range of phenomena that defines, and is defined by culture, he refers to wars as well, however in a negative sense, attributing an undermining role to tools of war for the prospect of cultural evolution. War can be considered a multi-faceted socio-technological phenomenon where human quest for progress, and capability of violence manifest themselves as social and cultural aspects of conflict management. Human, tool, and energy interrelation envisioned by White is the dynamic core of warfare. In alignment with cultural evolution and socio-technological developments, character of war has gone through incessant change throughout history. Complexity of war concept has aroused insatiable curiosity which made it subject of inquiry for psychology, anthropology, sociology, war studies, international relations, in addition to various other transdisciplinary areas. White's insight kindled the inspiration for this study which humbly aims to propose an alternative explanation for evolution of war from an anthropological perspective.

Social and technological changes in warfare support war evolution in a correlated way. The way humans fight changes over time with the progress in technological developments. With respect to energy usage, the first violence among humans might have probably started with punching or throwing stones with kinetic energy impetus. Whether it be human physical energy or chemical energy of gunpowder or any type of explosive substance, the input energy is converted into kinetic energy in order to exert lethality upon target. There is another option to warfare which can be considered a breakthrough in weapon technology, and that is directed energy weapons (DEW) based on electromagnetic (EM) energy principles. DEW typically use the electrical energy to produce EM radiation, and deliver it onto target as a beam, thereby having weaponized the energy. Among a variety of directed energy systems, laser is foregrounded with respect to its relative feasibility and effectiveness for military. Laser is an abbreviation for light amplification for stimulated emission of radiation which mainly describes the beam of concentrated EM radiation. For the purposes of being concise, this study focuses only on lasers, and its prospective influence on the changing character of war.

With the scope of energy utilization in combat, this study aims to understand the evolution of war with respect to human and non-human interaction; human denoting the military personnel who wields weapons which can be referred to as non-human participants of war. This interaction is discussed based on the collaboration of science, technology, and engineering for the purposes of military accomplishments. The research is conducted with an anthropological approach stemming from Science and Technology Studies (STS) groundworks.

The inquiry into the relation between the social and the technology has enhanced framing of STS with flexible boundaries offering an understanding of socio-technological phenomena over a wide range of disciplines. This thesis aims to bring an alternative explanation to the evolution of war from an STS point of view scrutinizing the mutual interaction between human and technology constituents of war. Development of certain technologies and artifacts is one of focus areas that STS elaborate. DEW, in particular laser systems, which is the subject matter of this study are products of high-technology materialized by arms industry in recent decades. The study can be considered a contribution to social evaluation of military technology which is a "*terra incognita*" (Meijers, 2009, p. 11) that needs to be investigated in order to reach a comprehension of dynamic coalescence of human, non-human entities of war. In this study, actor-network theory (ANT) is used to inquire into the tensions, and the mutual reinforcements of soldiers, and arms within war network together with engineers who contend with military technology.

## **RESULTS**

### **Methodology**

Literature search was conducted via printed material, in addition to digital written, audio, and visual sources regarding science and technology studies, and defense industry. Anthropology literature was searched in order to find relevant theories for explanation of technology advent and its implications. Additionally, STS sources related to various disciplines were overviewed. Literature of philosophy offered the most numerous sources regarding energy relevant to this study. Theories and unstructured approaches to war evolution were sought in the related literature. News, articles, and advertisements of recent laser weapon systems on online news platforms had to be closely followed in order to trace

the recent developments. Due to the dynamic nature of technology developments, local and foreign social media accounts related to arms industry were followed not to miss news and comments regarding recent progress. Trade shows, exhibitions, and fairs served as a diverse arena for field research providing opportunities to reach informants, and be able to observe the outputs of laser technology first-hand even though limited number of products were displayed.

In order to unfold first word of mouth accounts from distinct perspectives in Turkey, knowledgeable informants representing technology and military were contacted as interviewees in the fieldwork. In-depth interviews were conducted with engineers from defense industry. Since these systems have not been actively used in conflict zones, and even in military drills, so far there is no acknowledged experience associated with these weapon systems that the military staff can share. Moreover, there would be constraints in meeting with military personnel at active duty due to armed forces' privacy policy. Hence, retired military personnel with technical backgrounds who are still active followers of military technology were contacted to benefit from their knowledge and perceptions. In addition to these in-depth interviews where insightful information was solicited, additional interviews were conducted at exhibitions and the congress with knowledgeable professionals from the sector.

The concluding thoughts are based on the results including facts, and comments received from relevant sources.

## **DISCUSSION**

### **Weaponized Laser Technology**

Energy is essence of life and matter. It has a transcendental nature beyond earth. Its existence can be traced everywhere. Humans on earth is immersed in electromagnetic energy, and harness it for life preserving activities. Electromagnetic radiation which bears wavelike movement of photons, and is described in terms of energy, wavelength, and frequency.

Lasers' lethal effects on targets vary across a range of parameters such as laser intensity, the distance between the laser device and the target, in other words, range, and the characteristics of the target material. The retired officer interviewed explained that the

military always "starts planning from the end-point." This is probably consistent with any production planning or development of new products. Likewise, the ultimate objection defined by the range and target damage criteria determines the course of development for laser weapon systems. The preliminary step for damage exertion is to reach, and contact the surface of the target. Low energy lasers can cause temporary blinding of humans, or dazzling effect on electronics of a relevant target. High intensity lasers can drill a hole on the target by melting and evaporation through heating, or can cause buckling by mechanical means (Wheeler & Brehm, 2017).

### **Laser at War**

With the introduction of directed energy weapons harnessing electromagnetic energy, it is possible to classify the weapon systems in two groups in terms of the energy they exert, as kinetic energy weapons (KEWs) and directed energy weapons (DEWs) which includes laser weapons.

KEWs are mainly grouped into two major categories as shock weapons and missiles (Dupuy, 1980) with regards to the characteristics of the impact they exert. Kinetic weapons are effective on a broad range of kill-spectrum, but they have some drawbacks in response to novel asymmetric<sup>1</sup> threats such as swarm attacks of unmanned systems<sup>2</sup>. Moreover, kinetic weapon solutions are considered to be too expensive for countering cheap threats. Whether single or in the form of swarms, drones and UAVs can be countered by lasers in a relatively more feasible way incurring less cost. As forthcoming technologies render overwhelming swarms of unmanned systems possible, the demand for laser weapons is expected to increase.

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<sup>1</sup> According to the definition in the Encyclopedia Britannica (Sexton, 2016) **asymmetrical warfare** involves "unconventional strategies and tactics adopted by a force when the military capabilities of belligerent powers are not simply unequal but are so significantly different that they cannot make the same sorts of attacks on each other.

<sup>2</sup> Unmanned systems, which are guided with remote control or by autonomous means such as unmanned aerial vehicles and unmanned surface vehicles (Roblin, 2019, September 30), can be major elements within asymmetric warfare. These unmanned systems can be organized to pose swarm attacks which is defined as "high-risk, coordinated assaults sometimes directed against multiple targets or building complexes, using mobile groups to circumvent security measures" (Collins, 2012).

Laser weapons are meant to be a whole spectrum engagement<sup>3</sup> systems from detection to damage exertion across soft-to-hard kill<sup>4</sup> lethality range. They are currently used in military applications in range finding, remote sensing for detecting a threat or a target, ordnance guiding toward its target, as well as warding off threats from adversary electronics by electronic means, in addition to supporting satellite communications systems, laser radar-based navigational aids, and also for law enforcement by blinding, or disorienting target temporarily (Wheeler & Brehm, 2017).

Devoid of atmosphere, space is the ideal medium for laser performance. In alignment with the ongoing research and development for ground-based laser weapons, the exploitation of space capabilities is also being pursued.

The aim of laser engineering for weaponizing the laser is to generate a collimated beam using the power efficiently that would propagate against the opposing effects of the medium with sufficient intensity to be able to exert the damage on the military target at a pre-detected range.

### **Laser as Non-human Non-object Actant in War Network**

Sight, sound, smell, touch, and taste are intelligible input received through senses. These stimulations nurture human awareness searching for the vital dynamics of life situations. War zones have been arenas of sensory elements since soldiers of ancient history are expected to be attentive to stimuli in order to develop a perception of combat dynamics. Sight, smell, and sound are significant identifying elements of warfare. All the sensory perceptions embodied as a sensescape is an important aspect of war taken into consideration in operational planning in military actions.

In modern warfare the sensory alertness of soldiers are undertaken by electronic sensors. Among many other utilizations, remote sensors are used for target or threat detection, and over-viewing the war theater. One of the most prominent advantages of laser weapons is that the emitted beam has inherent stealth characteristics. It can be described as a beam of invisible electromagnetic radiation emitting no sound or smell with no sensory traces, almost totally concealed from remote sensing technology.

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<sup>3</sup> Engagement is defined as "attack against an air or missile threat" or "tactical conflict, usually between opposing lower echelons maneuver forces" (DOD Dictionary of Military and Associated Terms, 2021).

<sup>4</sup> Soft kill denotes "impairment of combat effectiveness" usually by electronic means, and hard kill refers to *physical destruction* of the target (Seigel, 1994).

Actor-Network Theory was first introduced by Bruno Latour and Michel Callon (1981) as a valuable contribution to Science and Technology Studies (as cited in Williams, 2020, p. 4). It proposes an explanation to the relations between human and non-human entities forming a network. Many scholars designate human and non-human elements of a network as actor and actant, respectively, equipped with agency imposing effect on one other within an interrelationship. Armed forces satisfy the definition of such a network with personnel as human actors, and lethal and non-lethal systems as non-human actants<sup>5</sup>.

Since the scope of the study focuses at war with its human and non-human elements, the interactions of soldiers and weapons irrespective of their sides within war will be foregrounded. Weapons and all the other instruments of war carry a potential impact that can change the course of war. Despite the common conception that it is the human beings who establish an architecture of soldiers and weapons, ANT underlines the indispensable significance of non-humans along humans, and attributes agency to both. According to ANT, non-human is ascribed agency as long as it acts within network.

Human and non-human participants of military are complementary figures that are assembled around a common purpose of victory. Consequently, this requires an organized collaboration of soldiers and weaponry. Human and non-human nodes of armed forces are mutually-interactive irrespective of duration of war extending beyond time and location of war. During peace, a soldier has to receive certain training to be able to use a gun. During fire exchange, the soldier who is in charge of his weapon needs to gauge the response of the weapon in order to determine their next step. They are in a vital cooperation of "shaping each other in and through their encounters," (Clark, 2020, p. 158). Without activation of the bonds inbetween the nodes of a military unit, the soldier-weapon assembly cannot accomplish enough. On the other hand human and non-human elements knit together in a network paves the way for military success. This would provide a typical example for "heterogeneous elements" assembled in "some given state of affairs," as Latour (2005) describes. In addition to reflexive mutual-response of the actor and the actant, there is also mutual-benefit involved in soldier-arms relationship. They engage in a very strong

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<sup>5</sup> Although non-human actants present in war would imply not only lethal instruments but also elements such as non-lethal remote sensors, etc., in this study for the purposes of appraising laser's role in war, non-human actants refer to weapons and ammunition, that is lethal elements of war.

"synergic activity" (Williams, 2020, p. vii) with each other due to the fact that accomplishment of their goal depends on the survival of their network. Their collaborative mission of maintaining security, also is diverted to each other for mutual-protection as participants of a common endeavor. In other words, they are in a symbiosis induced by their joint defense of themselves and of their bonds in a military engagement. This can be denoted as a "combined effort of the collaborative and cooperative activities... of human and nonhuman actants" (Williams, 2020, p. vii).

The introduction of lethal energy to the battlefield by laser technology would be a groundbreaking change that threatens the centrality of object weapon as non-human element of war. Future will show to what extent laser will replace material weapon systems and ammunitions. However, this new technology may instigate transformation of the battlefield. Non-human object actants can be replaced by non-human non-object energy actants. Laser may lead to *reification* of energy embodied in a beam which is to become the new candidate for non-human actants of military network.

## CONCLUSION

Direct energy usage as weapon was a concept of science-fiction about to be adopted by real science during the first half of 20th century when White wrote "Energy and the Evolution of Culture," (1943). Today, scientific research yielded the working principle for energy weapons, which in turn led to technology maturation with products ready for integration into war structure. At the present time, laser technology is under incessant development to enhance efficiency and effectiveness. Energy that has been used for sustenance of human life so far is materialized as a weapon.

The stunning change that laser brings to war is directed use of concentrated energy. The collimated, coherent beam of electromagnetic radiation is a new candidate for being a major combatant actant of the battlefield. It threatens to replace the object actants of war fight. Once fielded on the battleground, it is to become an agent of the conflict zone interacting with human actors and other non-human actants influencing the course of the combat. As tried to be explained in this study under contextualization of Actor Network Theory, laser is a potential non-human non-object actant connected to the other agents of war network. Despite the ceaseless debate of violence whether intrinsic human attribute or



not, the humane act of war is on the cusp of becoming less and less human and non-concrete rendering the war domains to the domination of energy. Together with already existing sensing, detection, and guiding systems using radiofrequency, infrared, or laser radiation, in the future, laser weapons may contribute to the dehumanization of war also supported by artificial intelligence, automation, and robotics.

Due to the political, social, and economic parameters, and the contingencies unforeseen for the world, it is not easy to draw a trajectory for laser weapons' technological development, and the role they will assume in the future warfare. Given the presumption that war and all of its constituents are under influence of various interconnected dynamics, the assessments drawn in this study is based on conservative anticipation, and may be considered as mere speculation for purposes of intellectual practice. Under uncertainty, almost all the informants agree on the partial inclusion of lasers on war zones as complementary force in the near future. The retired officer's comment was a well-known expression stressing the predominance of human actor at war; "Without boots on the ground you cannot seize an area." Though this is a referral to decisive significance of infantry branch as tacitly understood in the military, it underlines the indispensable agency of military personnel at combat. This perspective infers that only under considerable control of human actor, objects and things of war share the responsibility in victory or defeat.

The change that laser will exert on the character of war will be in line with the overall advent of war technology. Laser technology is considered to be an alternative to missile technology. It is presumed that projectiles will be replaced by lasers to some extent; that is to say, non-human actants of war will be diversified as objects and directed energy such as laser. This will entail dematerialization of military engagement on a route from concrete to abstract. The explanation of the engineer with military background supports this argument. He suggested that based on the current assumption of one percent laser usage to ninety-nine percent kinetic engagement against drones, in the future, might turn to sixty to forty percent usages respectively, laser increasing its share. The new character of war may be defined with respect to the new energy-based war instrument in addition to matter-based weaponry. A projectile is an object that can stimulate all humane senses in war environment. From bullets to missiles all projectiles have sensual attributes marking their agency. The modern conventional war region is like a theater of senses in action. Vehicle hit by a mortar would

draw a picturesque blast with fire and flash of light lifting a cloud of dust and smoke. The accompanying sound is deafening for the nearby individuals, and murderous for the victims. The sense of heat and pressure from the explosion triggers humane instinct of escape, leading people run away till the smell of death and destruction is left behind. Whizzing bullets, exploding mines, and rockets fired from fighter jets even add more to the commotion and debris. This audacious sensescape is war theater made up of visionscape, soundscape, smellscape, and touchscape. Everything about war appeals to senses. That is why combatants are expected to be alert, and open to detect every change on the battleground.

If and when the physical presence of ordnance is replaced by laser beams, almost all the sensual elements would be eliminated from the theater of war. Laser is invisible, silent, does not smell, does not arouse sense of pressure or heat as long as a person is not directly targeted; furthermore, it does not cause dust and smoke across the battleground. From retired officer's point of view, silence attribute would be an advantage, and he appreciated that laser would not raise any dust. Additionally, he mentioned his expectation of future capabilities such as hitting a plane as an element of air defence. Laser is a non-object thing numb to human senses, only to be detected by remote sensing technology to some extent. For the far future it has the potential to obliterate projectiles, and all the sensual stimuli associated with them. Lasers may create silent, unseen wars undetected by senses; thereby leaving the detection task solely to military remote sensing equipment. Character of war may be redefined as devoid of sense and stimuli.

Laser weapon capabilities such as precision, speed, range, scalability of effects, deep magazine, and stealth will meet distinct requirements of military missions. Among these especially speed, and range are properties that may transgress the boundaries of war theater. Adaptability to all kinds of platforms, its speed of light, and performance over unaccustomed long ranges may expand military operations across all domains of land, sea, and air leaping into space. The traditional term of battleground or battlefield may be replaced by battlespace as seen in recent literature. Such a vision may require substantial changes not only in military doctrines but essentially for national security policies of states due to probable future space wars.

Future will show if warfare will ever evolve into senseless, and dehumanized energyware with energy-based engagement instead of object-base. The redefined character of war can be described as laser-integrated flexible network with human actors and non-human actants on a whole engagement spectrum, across all domains, and all phases of conflicts with tactical and strategic implications on battlespace. Ambiguity in changing character of war due to military relevance of lasers cannot be resolved at the present time. Anthropology may encounter with more material to process as science and technology experts and military personnel get more familiar with this possibly new type of warfare. While human actors are still the main decision-makers in war network, human wisdom is critically important more than ever. Otherwise, lasers, as one of the informants expressed, "might be a product of a pessimistic future" for humanity...

Preprint

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