Human Performance Enhancement for Warfare: Where Do We Stand?

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तो ले, मैं भी अब जाता हूँ,
अन्तिम संकल्प सुनाता हूँ।
याचना नहीं, अब रण होगा,
जीवन–जय या कि मरण होगा।

As I leave peace behind,
Hear thou this resolve,
No entreaties, there shall be war,
From the living, martyrs shall evolve.
– *Rashmirathi* – 7th Chapter

I start this article, with the *Mahabharata*, not a religious epic, but the greatest epic on war in human history. This threat of war was given by Keshav, the military assistant to the chief of the army and ambassador of the king, ill-treated at the enemy court. He chose to threaten, even though he was aware that his army was only two-thirds that of the enemy [seven armies *(Akshohinis = 2,20,000*

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men) against eleven], with one-tenth the number of accomplished generals [seven *(Maharathis)* against nearly fifty].[1]

The threat was conveyed in the enemy's court, without fear, notwithstanding the force mismatch. Keshav then proceeded to embody Human Performance Enhancement (HPE) and used it effectively. The enhancement was physical, a hugely enlarged form, with increased strength. It also made him look scarier, meaner and indomitable. But the most important enhancement was cognitive, where a new, different and unbeatable philosophy proved the enemy to be inferior and cognitively weak.

मुझे बाँधने आया है?

जंजीर बड़ी क्या लाया है?

Thou that wish to tie me up,
Have thou a chain large enough?

The enemy king, indeed, did not have a chain large enough to tie Keshav in his enhanced form, and had to return him unharmed. Whether this narration is true or the author's imagination is a moot point. However, it does prove that the importance of HPE was appreciated (at least by military writers) a few millennia ago. Going further into the story, the Pandavas won the war, losing none of their *Maharathis*, while the enemy, despite being trained equally well and much larger in number, lost the war as well as most of their *Maharathis*. With both training and weapons equally matched, it was ultimately the human performance and its enhancement by Keshav that tipped the balance.

1. *The Mahabharata of Krishna-Dwaipayana Vyasa,* translated by Kisari Mohan Ganguli. Archived May 11, 2008 at the Wayback Machine at the Internet Sacred Text Archive.

Instances of HPE in the *Mahabharat* are many like the indestructible body armour of Rashmirathi, the hardening of Duryodhan's body, Vidur's penetrating sense of sight *(divyadrishti),* and so on. These have been described elsewhere. In later recorded history as well, there are numerous instances of HPE turning the tide of war.

Militaries have sought to improve the combat effectiveness of soldiers throughout history. Enhancement of physical strength and endurance, cognitive ability, human senses and equipment are together known as Human Performance Enhancement (HPE). This has been achieved by training, technology, substances and drugs, and mental conditioning. Some examples have been quoted below:

- The enhancement of Sparta's warriors through training and exercises is well known. Similarly, the training of the Aztecs to become some of the most physically enhanced warriors in the world.
- The teachings of Sun Tzu, Niccolo Machiavelli and Kautilya have been used in various cultures to enhance the king and ultimately make him worthy of winning wars.
- Napoleon's cognitive HPE created an 'undefeatable' French army. Similarly, Robert Clive, with his trained (read cognitively enhanced) military, managed to rout a much larger Mughal Army through a cognitive HPE that the Mughals did not possess.[2]

DEMOCRATISATION OF THE MILITARY AND HPE

Typically, till the 20th century, soldiers were chosen from the populace, with little training. Any form of enhancement was limited to only the generals. Consequently, the performance of the military was linked deeply to the abilities of the commander

2. W. Dalrymple, *The Anarchy: The Relentless Rise of the East India Company* (2019) ISBN 978-1-40886-437-1.

and there was little place for mass-scale HPE. The major change in the 20th century was the so-called democratisation of the military and, hence, the move to enhance each soldier.

- Visual enhancement of the Royal Air Force (RAF) through the newly developed 'radar' that played a major part in its victory in the Battle of Britain.[3]
- Similarly, the 'sonar' enhanced Leonardo da Vinci's sonic tube for detecting vessels in both the acuity and frequency response of hearing and is an unquestioned tool today. [4]
- Unlike the Roman or Mughal times or even World War I, now each soldier who serves in the military is trained professionally to achieve physical as well as cognitive enhancement. The so-called 'special forces' receive further HPE. Further, many soldiers receive specialised training for special tasks like bomb disposal, etc, a special case of which comprises pilots/ navigators/submariners, etc.
- Unarmed combat skills or the so-called martial arts add another dimension to HPE, wherein enhanced individuals can demonstrate phenomenal feats of strength. While references to martial arts from earlier times like Thacholi Othenan's *Kalarippayattu* abound, mass-scale training in martial arts is a recent phenomenon.

Today, physical enhancement through training, cognitive enhancement through professional military education, enhancement of sight [binoculars, telescopes, radars, Night Vision Glasses (NVGs), satellite imagery], enhancement of hearing (sonars, radio-telephony, hacking of communication lines), enhancement of smell/taste (chemical agent detection,

3. Len Deighton, *Fighter: The True Story of the Battle of Britain* (London: Pimlico, 1990), ISBN 978-0-7126-7423-2. (Originally published: London: Jonathan Cape, 1977.) ISBN 0-7126-7423-3.
4. Frank Fahy, *Fundamentals of Noise and Vibration* (John Taylor & Francis, 1998), p. 375. ISBN 978-0-419-24180-5.

poison detection) have become so commonplace that one forgets to acknowledge them as HPE.

RECENT ADDITIONS TO HPE

Maintenance of Attention: Somewhere in the first decade of this century, the Indian Air Force (IAF) recognised fatigue and the deterioration in performance caused by fatigue. Within the next few years, policies were formulated for maintenance of alertness, through both pharmaceutical and non-pharmaceutical means. The policies initially formulated for pilots have now been extended to all air warriors involved in operations, irrespective of the branch or trade (democratisation). The average air warrior is now getting conversant with Go-No-Go pills and their use is now accepted as a tool for HPE.[5]

Mindfulness: Mindfulness is a special case of enhancement of attention. The IAF has started a recent push on mindfulness.[6]

Nano-Technology. Nano-technology is gradually moving from the realm of sci-fi to actual use. Carbon Nano Tubules or CNT are 117 times stronger than steel and a tenth of the weight of steel. CNT body armour is being developed by various militaries. Implantable brain nano-chips can enhance brain functioning. Injectable chips can allow for real-time tracking of soldiers in the battle and for immediate assistance when needed.[7]

5. https://www.businessinsider.in/iaf-personnel-taking-authorised-pills/articleshow/50901573.cms#:~:text=The%20'Go'%20pill%20is%20Modafinil,sedative%20used%20to%20treat%20insomnia. Accessed on December 25, 2023.
6. A Velayudhan, et. al., "Mindfulness Training for Indian Armed Forces", https://www.i-scholar.in/index.php/ijpp/article/view/49912. Accessed on December 25, 2023.
7. Alejandro Molestina, Karthik Raja, Ravichandran and N. Michael Welleck, "Military Applications of Nanotechnology," *Student Papers in Public Policy*, vol. 2, issue 1, 2020. Available at: https://docs.lib.purdue.edu/sppp/vol2/iss1/5.

Bio-Technology: DNA storage for the identification of pilots, special forces personnel, etc is already being done.

- The quick response to COVID-19 demonstrated an enhanced capability to counter biological warfare. The quickly developed vaccine enhanced the immunity of crores of humans in a very short time.
- It may actually be possible to edit genes to make soldiers who are resistant to certain known biological as well as chemical agents. Gene alteration can also, theoretically, allow for more (or less) aggressive soldiers, better thinking generals, etc.
- Use of sight to look for more able-bodied soldiers is commonplace. The use of genome sequencing for selections is no longer a far-fetched idea. It may allow the military to choose the strongest, smartest and most efficient soldiers.

Info-Technology: Information technology has impacted warfare in so many ways that it is difficult to keep track. On the one hand, satellite technology and Network-Centric Warfare (NCW) have changed warfare in ways unimaginable just fifty years ago, while, on the other hand, less remembered things like fly-by-wire enhance the human capability to fly 'unflyable' aircraft like the B2 bomber. Even citing examples of how infotech has helped in HPE will run into many pages and is not being attempted here.

Cognitive Enhancement: Cognitive enhancement for HPE is a developing field with some technologies already in use and others being developed. Alertness management medication is one such technology that is already in use. Some others are mentioned below:

- **Brain-Computer Interface (BCI)**: BCI allows the brain to directly control computers through a connecting interface. Certain things already in use are bionic limbs, etc. Theoretically,

it is possible for BCI to fly aeroplanes, leaving the hands free for other tasks.[8]

- **Augmented Reality (AR)**: AR is already in use in hi-tech weapon systems, including aircraft. It allows for much better situational awareness and faster cognition, enhancing memory and improving decision times.
- **Simulation**: Simulation has been used for a few decades now, with newer technology constantly evolving. War-gaming using simulators can create whole battlefields, different weapon systems, etc as much enhanced cognition.
- **Physical Brain Stimulation**: Physical brain stimulation using electricity, magnetism, etc is in use. Presently, it is in use to treat patients with cognitive impairment. Transcranial electrical stimulation as well as transcranial magnetic stimulation have been used. Theoretically, it is possible to use these technologies to improve performance, but also to make a soldier act in a particular fashion, even against his wishes or beliefs. The ethical issues with these technologies have been discussed briefly, later.[ix]

THE FUTURE IS CONVERGENCE OF NANO, BIO, INFO AND COGNITIVE (NBIC)

While individually, each of these technologies has allowed for HPE, the future is a convergence of NBIC to enhance the human being. This will give rise to ethical issues, which will be brought out in the next section.

Combining nano with info can allow for implantation of a nano-chip for BCI, allowing for both control of a machine without using the hands, as well as controlling a human being using a computer. Adding bio-tech to this, using gene editing,

8. S. Shao, J. Wu and Q. Zhou, "Developments and Challenges in Human Performance Enhancement Technology", Med Nov Technol Dev, 12 (2021), Article 100095, 10.1016/j.medntd.2021.100095.

could make the brain more receptive to the implanted chip, rather than individual thoughts. The cognitive enhancement that may be brought about by one or more implanted chips is easily understandable. A Carbon Nano-Tubules (CNT) exoskeleton will make this soldier immune to many weapons. The addition of robotic technology to the exoskeleton could enhance human strength enormously. Further gene editing could provide immunity from certain chemical as well as biological weapons. Radiation-resistant genes are already known. The result would be a super soldier, who may be mass-produced. He would also obey unquestioningly, be fearless, and be virtually unstoppable.

ETHICAL DILEMMAS

This cyborg-like vision may be exciting to some and disgusting to others, depending upon their social and ethical sensibilities. Some ethical questions are thrown up by this:

- How can we even think about changing a human thus? Is it even allowed?
- If so, who gives this permission? The soldier, or his commanding officer, or the supreme commander?
- What if the soldier wants to remain human, rather than enhanced? Can we force this upon him?

These are not easy questions to address. The military leader who has to order HPE is not likely to find it easy till he can lay the ethical dilemmas to rest. Hence, even if uncomfortable, these issues need to be discussed. Some rhetorical counter-questions are placed below:

- What if we can make the process reversible. We change a soldier for battle, or for a pre-decided period, and then change him back to the original. This is easily possible with things like implantable chips, exoskeletons, etc. Are these possible with things like Clustered Regularly Interspaced Short Palindromic

Repeats (CRISPR) technology? I don't know. Having said that, I'm sure, we can find a way if we try hard enough. If so, we can wait till we find a reversible option.

- There may be some who will volunteer for this. Some, may be those in the special forces, who have faced an adversary and understand that this is the only way. We should not hold back technology from them, for that could make them vulnerable. In a game of life and death, better changed than dead.
- We could work equally hard with the judiciary and civil rights groups to find an ethical place, an "in-between", which is acceptable. After all, aren't we doing this for various issues? India is working on homosexuality, the US on abortion rights, and the Middle East on women's driving licences. The second two scenarios are a no-brainer for Indians, but extremely important for the respective countries. I am sure the US thinks the same for gay marriages, or the Middle East about the death penalty. Each has its own ethical dilemmas, and has to find its own solutions.

Having said this, let's do a fact-check. In the past decade, according to certain open source estimates, China has invested more than US$ 400 billion in nano-technology, more than the rest of the world put together. Similarly, China has been making giant leaps in quantum computing, though the exact outlay is difficult to estimate.[9]

It is a moot point whether or not COVID-19 leaked from a Chinese laboratory. Be that as it may, investigations into the COVID pandemic did reveal that the Wuhan laboratory was conducting gain-of-function research there, while the US was funding gain-of-function research. The US government has already cleared the use of CRISPR technology for sickle cell anaemia and certain

9. *China Statistical Yearbook, 2022*, https://www.stats.gov.cn/sj/ndsj/2022/indexeh.htm.

other diseases. As far back as 2001, the US military had its first conference on the convergence of NBIC technology for HPE.

There is no doubt in my mind that many militaries, including those of our prime adversaries, are working on HPE. In India, however, it is not only the military that our armed forces are pitted against. Perpetrators of grey zone warfare are less ethically constrained than governments. The effects of mutilations carried out by the Islamic State of Iraq and Syria (ISIS) on the psyche of adversaries are known. The effect of huge, moustachioed ferocious soldiers on their adversaries is known. The only question then is, would I like to be the scary or the scared?

Will I lose fewer soldiers if I am enhanced? The answer is yes. Is it better to have an enhanced soldier or a dead soldier? Again, the answer is obvious. The final question is, will I create a monster, a Frankenstein? This question has no easy answers. I will have to make remaining human more attractive than becoming a Frankenstein. Then and only then will people remain content with being human. Will this come naturally? NO. It will have to be worked upon in a designed framework, which also means that the more research we do into HPE, the higher are the chances that we will be able to tackle the enemy Frankenstein without turning into cyborgs ourselves. The time to start this research was yesterday.

SO WHAT DOES ONE DO?

This is the final question. The following framework is recommended:

- Formulation of a policy for HPE and a timeline of its implementation. As has been mentioned above, this is already delayed.
- The conference on NBIC convergence by the US military took place more than two decades ago. There is a serious need to look at other avenues for HPE. A think-tank for newer and more effective methods of HPE needs to be set up. The author has certain ideas.

- The scientific community in India is gradually maturing. Involvement of civilian think-tanks into the fold of HPE will definitely help.
- The benefits of HPE in civilian life will greatly increase the participation of industry in this sphere. It will also benefit the population at large. Hence, there is a reason to involve the civil population in HPE.
- In the interim, there is a need to increase targetted research into NBIC technologies. This is better done today than as a haphazard response to cyborgs unleashed by the adversary. The rapid development of Indian-made vaccines against COVID was a demonstration of the use of bio-tech to counter a bio-tech war.