

Research Article

ARTIFICIAL INTELLIGENCE, BRAIN AUGMENTATION, AND COGNITIVE WARFARE

* Prof M S S el Namaki

Dean, Artificial Intelligence Technologies (AIT), Canada.

Received 14th January 2026; Accepted 15th February 2026; Published online 30th March 2026

ABSTRACT

Artificial intelligence is becoming an amorphous whole. The concept, the tools, the applications, the investment, and the outlook are going through a process of evolution. Technology is trying to cope with known advances and unknown outlooks. One of those known advances with unknown outlooks is brain augmentation and brain warfare. The concept is recent and seems to gain a prominent place in current AI frameworks. How does artificial intelligence relate to brain augmentation and how will brain augmentation lead to brain warfare? This will be the focus of this article. The article starts with a set of definitions starting with AI and ending with brain augmentation and brain hostility. This is followed by an examination of cognitive warfare in terms of triggers and inducers. Analysis is qualitative. Outcomes are hypotheses for future research.

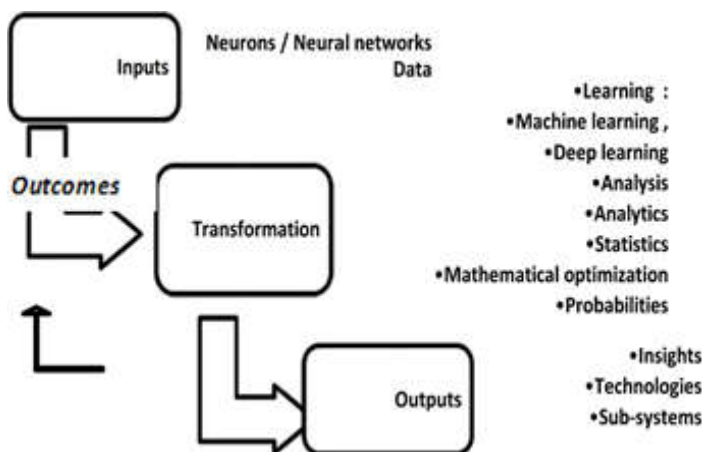
Keywords: Artificial intelligence, AI frameworks, brain augmentation, Cognitive Warfare.

WHAT IS ARTIFICIAL INTELLIGENCE?

Artificial intelligence is a concept with many shadows, roots, and branches. Exploring the concept could involve a wide variety of approaches. Earlier work by the author resorted to system's theory to display a silhouette, trace the building elements. of the structure and identify the flows. The assumption was that the process of artificial intelligence is a consequential flow with several system components starting. with inputs and ending with outputs. A transformation process converts the inputs into outputs, and a feedback mechanism would adjust flows to deviations. The flow is. logic and conceptual elements did lend them to the analysis. Yet this was one way of approaching the concept. Another artificial intelligence concept, the context concept, introduced a progressive flow were symptoms and processes of artificial intelligence. follow a consequential pattern. The essence is a progression from a basic corrective. Mode to a limited memory function followed by a theory of mind application and a final phase of self awareness competency.

The following figure represents the system framework of artificial intelligence. It displays neural inputs, biological and synthetic, as inputs complemented by data. It then displays transformation mechanisms i.e. machine learning and deep learning software is leading to three categories of outputs: insights, technologies, and sub-systems. A feedback mechanism provides essential adjustments.

Figure: AI system flow



Source: A Systems Approach to the Artificial Intelligence Concept

M S S El Namaki * Received: 21 Jun. 2019, Revised: 12 Jul. 2019, Accepted: 24 Jul.2019. Published online: 1 Aug 2019.

WHAT IS BRAIN AUGMENTATION?

Brain augmentation is a subset of the broader concept of human augmentation, which encompasses various technologies designed to enhance physical and mental abilities. Technologies involved include brain implants, AI rooted brain computer interfaces, and cognitive enhancement technologies this includes devices that can improve memory, cognitive processing, and even sensory perception.

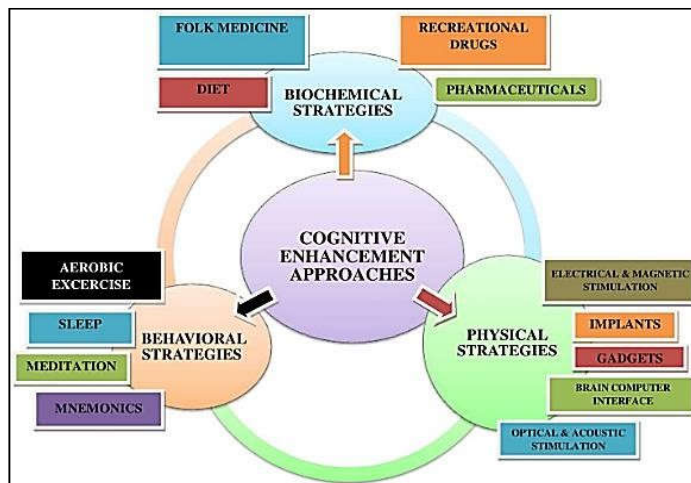
Brain augmentation specifically focuses on enhancing brain function through direct interaction with the neural systems. Neural AI interventions could provide the medium here. (Jangwan NS, et al., 2022).

Routine activities such as sleep and physical activities boost cognitive performance (Hötting and Röder, 2013; Diekelmann, 2014). Well-established cultural activities like musical training, dance, or learning a second language have been shown to boost cognition in ways that

*Corresponding Author: Prof M S S el Namaki, Dean, Artificial Intelligence Technologies (AIT), Canada.

are not related to the abilities being practiced (Seinfeld *et al.*, 2013). Numerous behavioral techniques have also been devised to actively increase certain brain processes. Commercial video games and personalized computer training are recent innovations aimed at enhancing certain cognitive capacities and skills (Green and Bavelier, 2012).

Figure: Cognitive enhancement approaches.



Source: Jangwan *et al.*, 2022

Brain augmentation for cognitive enhancement could resort to other more invasive techniques.

HOW DOES BRAIN AUGMENTATION TRANSLATE INTO COGNITIVE WARFARE?

The idea that the brain is the battlefield of the future is a growing concept. With the rapid advancement of neuroscience and technology cognitive warfare is becoming the medium.

Cognitive warfare constitutes a process aimed at changing the way a target population thinks and behaves. It is an unconventional mode of warfare that exploits individual psychological biases and reflexive thinking in order to manipulate human cognition, induce changes in thought and induce negative impacts. In cognitive warfare, information, true or false, serve as a medium of hostility inducing vulnerabilities and systemic weakening. (Lin, 2022). The ultimate objective is to shape and control the adversary's cognitive functions and, in the final analysis, manipulate and degrade values, emotions, spirit, cultural traditions, historical beliefs, and even political will. Cognitive warfare constitutes a battle on itself. The brain is seen as a medium and a target in a fight for cognitive superiority.

Artificial Intelligence supports cognitive warfare through the collection and analysis of a wide range of data on different target populations and the use of big data analysis, computing power, smartphones, social media platforms, etc. to try to simulate and calculate the target's thinking, mental and emotional cognition, social behaviour, public opinion, etc.

Cognitive warfare tools are advanced, multidisciplinary technologies and methods designed to manipulate human cognition, beliefs, and decision-making, using artificial intelligence, big data, social media, and psychological operations to weaken adversaries. Tools would include AI-enabled content generation, big data & sentiment analysis, social media digital platforms, neuro-technology tools:

The situation could have military consequences. It is becoming increasingly possible to manipulate and control the brain and behaviour of military individuals within a military context. For example, mind control and behaviour modification techniques could be used to manipulate enemy soldiers, or to create "super soldiers" with enhanced cognitive and physical abilities. The development of brain-computer interfaces, which allow direct communication between the brain and technology, could also provide new opportunities for remote control and surveillance.

In recent years, major military powers have invested heavily in research into human augmentation and cognitive warfare. The United States has positioned itself at the forefront of these developments, with the Defense Advanced Research Projects Agency (DARPA) spearheading projects to enhance cognitive function, physical endurance, and stress resistance. (<https://en.wikipedia.org/wiki/DARPA>). DARPA-funded projects have accelerated developments in neuro-enhancement and brain-machine interfaces for mission-critical applications.

US government and defence sectors are increasingly investing in cognitive enhancement technologies to improve soldier performance, reaction time, and resilience in high-stress environments. Brain augmentation tools such as neuro feedback systems and transcranial direct current stimulation (tDCS) are being researched to enhance memory, decision-making, and situational awareness in combat scenarios. (<https://dimensionmarketresearch.com/report/human-brain-augmentation-market/>).

The emerging hypotheses

Above analysis could lead to a number of hypotheses:

The first "Artificial intelligence could drive cognitive warfare by a wide variety of drivers all leading to the undermining of quality of individual decision making, the introduction of "grey" shadow societal norms and values."

The second: The brain is becoming a military arena where modes of hostility transcend conventional military hostility modes and scope."

The third: Modes of cognitive warfare will assume dimensions unknown to today's technologies."

The fourth: The defense sector's growing reliance on brain augmentation devices for tactical superiority is fuelling innovation and deployment. This military-driven demand significantly influences the global human brain augmentation market landscape.

Further research should substantiate and expand on this issue. Military and nonmilitary outcomes could emerge from this analysis.

SUMMARY AND CONCLUSIONS

Artificial intelligence is becoming an amorphous whole. The concept, the tools, the applications, the investment, and the outlook are going through a process of evolution. Technology is trying to cope with known advances and unknown outlooks. One of those known advances with unknown outlooks is brain augmentation and brain warfare. The concept is recent and seems to gain a prominent place in current AI frameworks.

How does artificial intelligence relate to brain augmentation and how will brain augmentation lead to brain warfare? This will be the focus of this article.

The article starts with a set of definitions starting with AI and ending with brain augmentation and brain hostility. This is followed by an examination of cognitive warfare in terms of triggers and inducers. Reference is made to the military dimension of the technology and US DARPA projects. Four hypotheses are derived from the analysis. Analysis is qualitative. Outcomes are hypotheses for future research.

REFERENCES

1. Jangwan, N. S., Ashraf, G. M., Ram, V., Singh, V., Alghamdi, B. S., Abuzenadah, A. M., & Singh, M. F. (2022). Brain augmentation and neuroscience technologies: current applications, challenges, ethics, and prospects. *Frontiers in Systems Neuroscience*, *16*, 1000495. doi: 10.3389/fnsys.2022.1000495
2. Sadeh, S., & Clopath, C. (2025). The emergence of Neuro AI: bridging neuroscience and artificial intelligence. *Nature Reviews Neuroscience*, *26*(9), 583–584. <https://doi.org/10.1038/s41583-025-00954-x>
3. Lin, Z. (2022, September 21). *The Escalation of the CCP's Cognitive Warfare — Undermining the National Will and Identity of the Taiwanese People*. Up Media. (Original content archived on March 30, 2023).
4. Backes, O., & Swab, A. (2019, November). *Cognitive Warfare: The Russian Threat to Election Integrity in the Baltic States*. Belfer Center for Science and International Affairs, Harvard Kennedy School. Retrieved October 20, 2025.
5. Hötting, K., & Röder, B. (2013). Beneficial Effects of Physical Exercise on Neuroplasticity and Cognition. *Neuroscience & Biobehavioral Reviews*, *37*(10), 2243–2257. <https://doi.org/10.1016/j.neubiorev.2013.04.005>
6. Bavelier, D., Green, C. S., Pouget, A., & Schrater, P. (2012). Brain plasticity through the life span: Learning to learn and action video games. *Annual Review of Neuroscience*, *35*, 391–416. <https://doi.org/10.1146/annurev-neuro-060909-152832>
7. Seinfeld, S., Figueroa, H., Ortiz-Gil, J., & Sanchez-Vives, M. V. (2013). Effects of music learning and piano practice on cognitive function, mood, and quality of life in older adults. *Frontiers in Psychology*, *4*, 810. doi: 10.3389/fpsyg.2013.00810
8. Lin, X. V., et al. (2022). Few-Shot Learning with Multilingual Generative Language Models. In *Proceedings of EMNLP 2022* (pp. 9019-9052). Abu Dhabi, 7-11 December 2022. <https://aclanthology.org/2022.emnlp-main>.
9. Défense Advanced Research Projects Agency. (n.d.). *DARPA*. Wikipedia. Retrieved from <https://en.wikipedia.org/wiki/DARPA>
