**Fighting for brain control, how can we win the future war without fighting?**

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**Author: Guo Yunfei**

**Editor: Shang Xiaomin**

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**Cognitive domain warfare enters the era of competition for brain control**

**Tips**

●Different from the currently well-known physical domain warfare and information domain warfare, cognitive domain warfare better embodies the combat idea of ​​"defeating the enemy without fighting."

●The weapon of cognitive domain warfare is information. Wherever information can be spread can become a battlefield.

●With the support of artificial intelligence technology, the infinite potential of the human brain will be developed, and the development of brain science and technology is expected to give birth to new cognitive domain combat modes such as brain reading, brain-like, brain control, and brain strengthening that directly target the brain.

The combat space of modern warfare has formed three major combat domains: physical domain, information domain, and cognitive domain. The cognitive domain has become the ultimate domain of great power games and military confrontations. Cognitive domain operations directly act on brain cognition through special means to influence its emotions, motivations, judgments and behaviors, and even achieve the purpose of controlling the brain. As a cognitive carrier, the brain may become the main battlefield of future wars. Control over the brain will soon become the key to cognitive domain operations and the highest level of control over war.

**Ancient and emerging cognitive domain operations**

Different from the currently well-known physical domain warfare and information domain warfare, cognitive domain warfare better embodies the operational idea of ​​"defeating the enemy without fighting". The game and confrontation in cognitive space have existed since ancient times, almost throughout the thousands of years of human war history. In ancient my country, it was called "psychological warfare" and "psychological warfare". In primitive society, tribal leaders usually used the sound of drums and the tune of footsteps to inspire their own morale and mentally deter the enemy. This can be said to be the prototype of cognitive domain warfare. In the cold weapon era and the early hot weapon era, people gradually realized the justice of war and the influence of factors such as the people's support on the victory or defeat of war. They widely used the release of war manifestos, war tables, notices and other methods to expose the enemy's crimes, thereby inspiring the fighting spirit of the soldiers and achieving the effect of preemptive victory.

After the second scientific and technological revolution, broadcasting became an important means of information dissemination, and the channels for the use of cognitive domain operations were further expanded. The British Broadcasting Corporation (BBC) and Luxembourg's "Voice of the Battlefield" have both played a huge role in winning hearts and minds. After the third scientific and technological revolution, cognitive domain operations are no longer limited to media propaganda based on voice and text, but can use a variety of means such as film and television images, virtual reality, and cognitive control. Modern cognitive domain operations have gradually become more intensive and all-round, greatly improving the scale, level, and effectiveness of cognitive domain operations. Since the fourth scientific and technological revolution, with the development of artificial intelligence technology, especially the maturity of computer speech synthesis and image processing technology, faces can be replaced, voices can be misplaced, and images can be completely changed. This can be used in the military to achieve military tricks such as "stealing beams and replacing pillars" and "making the fake look real", which is even more effective.

In short, through the continuous advancement of technology, from single text and voice to broadcasting, video, and the Internet - more and more media can be used to influence the enemy's thinking, judgment, and cognition, constantly bringing new modes of cognitive domain warfare.

**The era of cognitive domain control has arrived**

The weapon of cognitive domain operations is information. Wherever information can be spread, it can become a battlefield. The key to information dissemination is the medium, and the medium is ubiquitous in today's network society. With the development of network technology, the collection, storage, and processing of information are highly dependent on information networks. The leading role of information in integrated joint combat command is becoming increasingly prominent. From understanding intentions, analyzing and judging, making decisions, command and control, firepower strikes to combat assessment, all aspects cannot be separated from the support of information networks. Ubiquitous media provide prerequisites and effective support for conducting cognitive domain operations.

Engels once pointed out: "Once technological advances can be used for military purposes and have been used for military purposes, they will immediately and almost forcibly, and often against the will of the commander, cause changes or even revolutions in the way of warfare." In recent years, the development of brain science and artificial intelligence technology has shown a cross-border integration trend, which is one of the most outstanding advances in the field of science in the 21st century. Supported by artificial intelligence technology, the infinite potential of the human brain will be developed, and the development of brain science and technology is expected to give birth to new cognitive domain combat modes that directly target the brain, such as reading the brain, imitating the brain, controlling the brain, and strengthening the brain.

"Brain reading" means extracting information from the human brain, such as pictures, texts, voices, videos, etc. stored in the brain, which can be used to obtain enemy intelligence, etc. Modern cognitive neuroscience and functional magnetic resonance imaging technology can already interpret the information of neuronal activity in the brain in real time without side effects. By reading this information, quantitative analysis of brain activity is carried out, and the purpose of parsing and reading human brain thinking activities is ultimately achieved. At present, visual parsing technology based on functional magnetic resonance imaging has been proven to restore the images seen by the brain. A 2019 study showed that artificial speech synthesis technology based on brain wave signals can extract signals in the brain and synthesize speech that humans can directly understand.

"Brain-like" means making machines more intelligent by imitating the way human brain neurons process information. Machines can use brain-like methods to process massive amounts of information and complete autonomous learning, improving their own intelligence level like the human brain. At present, the main research directions of brain-like are brain-like neural chips, processors with active learning capabilities, and intelligent robots. In the future, anti-terrorism and anti-riot robots, emergency rescue robots, reconnaissance robots, drones, etc. in the military field can achieve real-time target monitoring, tracking, voice control, obstacle avoidance and other combat functions with only one brain-like chip.

"Brain control" means using external stimuli, such as electricity and magnetism, to interfere with, destroy or even control brain neural activities, thereby changing people's cognitive functions. In principle, it is to influence the nervous system of enemy soldiers through technical means, so that they take actions that harm their own interests under the guidance of external signals, such as changing orders and laying down weapons. At present, many institutions in the world are trying to implant electrode chips in the brains of certain animals to control their behavior, thereby turning them into undetectable spies to achieve tasks such as reconnaissance, tracking, surveillance and attack.

"Brain strengthening" means enhancing people's cognitive functions through neurofeedback technology or electromagnetic stimulation technology, which can be used to improve the effectiveness of military training and enhance combat effectiveness. Real-time neurofeedback technology can train and reshape the brain, improve brain cognitive functions, and thus improve cognitive combat capabilities. A clinical trial in Israel has shown that training soldiers with neurofeedback technology can effectively alleviate their "alexithymia" and enhance their ability to withstand stress.

The use of brain science and technology in cognitive domain warfare can achieve the purpose of war more directly. Therefore, the status and application value of brain science and technology in the military field are becoming increasingly prominent. The rapid development and integration of brain science and related sciences have brought major opportunities for the theoretical transformation of cognitive domain warfare and the development of weapons and equipment. The struggle for brain control has become a new field of competition among military powers, and cognitive domain warfare has entered the era of brain control.

**There are still many hurdles to overcome on the road to brain control battlefield**

The rapid development of brain science and technology will inevitably give rise to new combat theories, combat equipment, and combat styles, and even lead to a new round of military reforms. However, there are still many hurdles to overcome before brain science and technology can truly move from the experimental environment to the battlefield.

It is urgent to strengthen the research on cognitive domain warfare theory. We should insist on the development of military theory first, and provide scientific theoretical guidance for the military application of brain science and technology through theoretical guidance. At present, the theory and technology of cognitive domain warfare have developed to a certain extent, but are still in the early exploration stage. We should strengthen the research on the combat thinking, combat methods, combat styles, and combat means of cognitive domain warfare, and then guide the development of brain science, psychological influence, information dissemination and other technologies, which is the basis for seizing brain control in the future.

It is urgent to strengthen the research and development of cutting-edge technologies. It can be predicted that with the increase in investment in brain science and technology research and development in various countries in the future, brain science and technology will usher in rapid development. We should focus on early layout and focus on key technologies: "Brain reading" technology should work hard on brain networks, neural circuit analysis, visual perception, advanced cognitive analysis, etc.; "Brain-like" technology should work hard on breakthroughs in new neuron-like semiconductor devices and the development of high-performance military brain-like electronic information systems; "Brain control" technology should focus on developing information systems that can monitor and intervene in brain thinking activities, and create new "mind control" equipment; the key to "strong brain" technology is to study portable integrated brain information collection equipment and non-destructive neural feedback technology.

There is an urgent need to standardize the ethical rules of brain science. The rapid development of brain science has brought risks to human ethics and morality. In experimental research on humans, if we only emphasize the scientific nature of the research, it may sometimes cause harm to humans. Therefore, we should strengthen the research on brain science ethics and standardize the framework of brain science experiments. We can reasonably use ethical norms to counter some countries and institutions that violate humanitarianism and secretly develop brain control technology.

*(Author's unit: Information Engineering University)*