Observation of cognitive combat capabilities outside the domain

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【Abstract】Cognitive domain warfare is a form of warfare and a method of warfare that uses theories of modern cognitive science and other related disciplines, and uses a variety of cutting-edge technologies and methods to compete with the affected objects for views, attitudes, concepts, and positions, so as to achieve cognitive influence and cognitive shaping, and then promote the formation of a cognitive situation that is beneficial to oneself. The United States, NATO, Russia and other extraterritorial countries and international organizations have carried out a wealth of strategic deployments and practices in the field of cognitive domain warfare, and have shown different characteristics, showing the pursuit of endless cutting-edge technologies and theories by these countries and international organizations in the cognitive domain warfare game. With the development and progress of related technologies, the technologies and theories of cognitive domain warfare of extraterritorial countries will be further enriched and developed.

【Key words】cognitive science, cognitive domain, combat, cognitive theory, cognitive technology

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As human society enters the 21st century, new products, new things, and new inventions continue to emerge, new viewpoints, new theories, and new ideas continue to form, and new formats, new communities, and new social relations continue to emerge. In particular, with the rapid development and evolution of computer science, Internet technology, communication technology, natural language processing, big data, media technology, and artificial intelligence, human society has entered an era of great development and further integration of the physical domain, information domain, and social domain, reflecting the characteristics of rapid development and change of things and rapid update and dissemination of information. In recent years, with the further development of cognitive science, society has shown a high degree of cognitive dominance, pursuit, and explosiveness. The content of information people obtain, the orientation of information flow, the path of information dissemination, and the effects of information dissemination all have a strong cognitive orientation, which in turn promotes the integration of the physical domain, information domain, social domain, and cognitive domain. The war form of human society has also undergone major changes, and a new form, cognitive domain warfare (referred to as cognitive warfare), has begun to appear. Cognitive domain warfare has become an important form of competition among the world's major countries. The cognitive domain has become the main battlefield for confrontation among the world's major countries. The concepts and technologies of cognitive domain warfare have also become the main areas of competition among the world's major countries. An endless frontier cognitive domain game has quietly unfolded.

**Concept and Characteristics of Cognitive Domain Operations**

Cognitive domain warfare is the use of theories from modern cognitive science, systems science, communication, linguistics, socioculture, social behavior and other related disciplines, and the use of a variety of cutting-edge technologies such as computer technology, network technology, media technology, cognitive technology, language technology, big data technology, neural network algorithms, and intelligent autonomous learning. It uses the collection, analysis, generation, delivery, and influence of multiple information contents such as text, pictures, sounds, and videos as means to compete for views, attitudes, concepts, identities, confidence, beliefs, faith, thoughts, and thinking on the objects affected. By influencing individuals or groups' cognition of specific people, events, plans, policies, military actions, systems, national positioning, national major policies, national history, national future development goals, traditional cultural concepts and ideologies in the fields of politics, economy, society, culture, national defense and military, education and science and technology, etc., it achieves cognitive influence, cognitive shaping, cognitive control and cognitive manipulation on the objects affected, thereby promoting the formation of combat forms and methods of cognitive situation that is beneficial to one's own side. From a process perspective, cognitive domain warfare is the use of multiple means and technologies in a high-tech environment and under conditions, covering multiple domains or even the entire domain, to influence the spirit, thoughts, thinking, and thinking of the target object. It is an influence on the entire process of the opponent's information perception, information reception, information processing, information understanding, information response, information generation, information release response, and information feeding. It is a clever influence and attack on the opponent's cognition through sophisticated design based on the cognitive field. Its fundamental purpose is to achieve cognitive confusion, cognitive blocking, cognitive deception, cognitive containment, cognitive intimidation, cognitive subversion, cognitive attack, cognitive transfer, and cognitive shaping of the opponent through cognitive pre-positioning, cognitive intervention, cognitive bombing, and cognitive transformation, and ultimately achieve the purpose of cognitively cooperating with one's own side to gain a favorable or winning situation in military struggle (Liang Xiaobo, 2022; Yu Xintian, 2022; Claverie; Cluzel, 2021).

As a very special combat form and method, cognitive domain combat has special combat targets, purposes, content, means and main manifestations, and therefore has its own characteristics.

Informational. Cognitive domain operations use information as the main carrier. Without information, cognitive domain operations are out of the question. The release of information may be in the form of text, pictures, sounds, and videos. The main forms of expression include various publications such as leaflets, newspapers, and books, works of art such as calligraphy, paintings, and music songs, as well as short videos, animations, advertisements, movies, and dramas. They can also be expressed as some products with special prompt information. Among the various information products, language information plays a leading role. Language information may be the main form, or it may play a role in adding the finishing touch, clarifying the purpose, and indicating the direction in various products. Information products are tangible, but the dissemination of information is unrestrained, and the impact of information is unpredictable. Therefore, cognitive domain operations dominated by information are becoming a form of war without gunpowder with huge potential impact.

Cognitive. The means, content, methods and effects of cognitive domain operations all reflect the characteristics of cognition. First of all, the "ammunition" of cognitive domain operations often takes the human brain's cognition of a specific problem or thing as the main offensive direction. The design of its content is deeply influenced by cognitive theory, and adopts theories such as cognitive prototype, cognitive attribution, cognitive shaping, cognitive framework, cognitive schema, cognitive prominence, cognitive preference, and cognitive rhetoric; in communication, it adopts theories such as cognitive selection, cognitive feeding, cognitive hunger, cognitive conformity, cognitive model, cognitive network, cognitive community, cognitive polarization, cognitive induction, cognitive interaction, cognitive anchoring, and cognitive social culture; in the setting of themes and topics, it adopts theories such as cognitive culture, cognitive semantics, cognitive grafting, cognitive deception, cognitive deterrence, cognitive overload, cognitive split, cognitive transfer, and cognitive blockade; in rhetorical style, it has the characteristics of conceptual metaphor, double entendre, semantic irony, creative analogy, third-party omnipotent eye, Internet language, and freshness and agility. In general, in cognitive domain operations, its cognition becomes the main orientation (Liang Xiaobo, 2022).

Networked. Although people live in physical space, the vast majority of people show their presence in cyberspace. The Internet is changing people's traditional lifestyles. People can solve food, clothing, housing, transportation, entertainment, sightseeing, learning and education through the Internet. Online social media has replaced traditional social life and become a new tool for people to carry out social activities. The Internet, virtual networks, and social media networks in modern society are more important, developed, and influential than the networks in physical society. Online groups have become an important group expression and existence in today's society. Cognitive domain operations rely on various online social media. Therefore, the Internet has become the main place to influence people's views, attitudes, and positions on a wide range of issues, and it has also become the main battle space for cognitive domain operations.

Narrative. Communication, which mainly takes the form of word-of-mouth in real physical space and key-to-key communication in virtual cyberspace, is an important form of communication in cognitive domain operations. In addition to being affected by the Internet, the narrative of the content itself is also extremely important in the dissemination of texts and content. Whether or not influential stories can be created and produced has become an important factor affecting the effectiveness of cognitive domain operations. Grand narratives, micro-narratives, multi-narratives, and integrated media narratives in narratives will become important forms of expression in cognitive domain operations. Among them, world civilization, national development, international relations, cultural heritage, typical figures, major events, important policies, crises and disasters, patriotism, and family and country feelings have become important areas of competition in cognitive domain operations, such as world development ideas, world civilization views, world peace and national security, global governance and international order concepts, international relations theories, national development theories, national image positioning, the legitimacy of national existence and the right to development, etc. In recent years, the ability to fight the COVID-19 pandemic, the effectiveness of vaccines, and the supreme respect for life have become important topics in the cognitive domain game between countries.

Emotionality. Cognitive domain texts often have emotional expressions that are explicit or implicit, strong or weak. This type of emotional expression is often expressed explicitly or implicitly in the text, deeply rooted in clear opinions and attitudes or vague cognitive positions, co-existing and merging in the text's semantic field and framework, and also connected and matched in the adaptation of the topic and material selection, bridged in reasoning and examples, and strengthened through the frequent use of conceptual metaphors, puns, repetitions, irony and other rhetorical techniques, so that the relevant objects are intoxicated in the fascinating and constantly changing story emotions, resonate in the text subject matter and genre, and gain a sense of reality in the embodiment of the sense of personal experience and freshness, and gain empathy in the emotional simplicity, emotional authenticity, and emotional integration of the text. In cognitive domain operations, obtaining the embodiment, identification, and empathy of the other party's emotions is the emotional belonging goal.

Fake or real. Cognitive domain operations are often filled with information that is a combination of fake and real, and difficult to distinguish between true and false. Since brain cognition is based on the first information contact as the cognitive prototype, subsequent cognition is deleted, modified and repaired on this basis. The first information and the first impression often become important points of contention in cognitive games, which is also the reason why "the truth is not important" at present, that is, the advent of the "post-truth era" that people often say. For this reason, the first information release for a certain object is very important. In order to seize the other party's first cognition of a certain thing, both parties in the cognitive game often release information that is a combination of fake and real, and difficult to distinguish between true and false, on a certain thing, which is likely to sacrifice the authenticity of the information. False information and real information are often combined together, and cooperate with the generation and dissemination of a large amount of information, with the purpose of confusing and confusing the other party's cognition in terms of information flow, flow rate and flow direction, especially using false information to erode real information, interfere with the other party's cognition, and thus affect the other party's judgment and thinking. The combination of reality and fiction makes it impossible for the other party to make a judgment of the truth at the first time. In this way, the other party's concept and impression of a certain thing are constructed at this stage, and their perception and understanding of a certain thing are shaped, and then the other party's overall judgment and decision-making are influenced, thereby achieving the goal of manipulating the other party's thoughts and consciousness and influencing the other party's actions and behaviors. When the reality and fiction are completely clarified or the mystery is completely revealed, the truth of the facts is no longer important, because the competition for the cognitive domain has entered the next critical stage, and the progress of the war has also reached a new point of contention.

Timing. Cognitive domain operations are reflected both at the strategic level and at the specific campaign and tactical levels. Every military action, whether macro or micro, requires the cooperation of cognitive domain operations, and more importantly, requires reasonable planning of cognitive domain operations. Therefore, cognitive domain operations also reflect strong timing. The release of the main "ammunition" of cognitive domain operations has obvious timing restrictions. Strategic cognitive domain operations require global design and deployment, which plays a decisive and leading role in overall and micro cognitive domain operations; specific cognitive domain operations provide services and support for macro and strategic designs. Macro strategic cognitive domain operations will run through the entire process, while micro specific cognitive domain operations are mainly to serve the needs of specific times and specific actions. Strategic cognitive domain operations can achieve the effect of "defeating the enemy without fighting", while micro cognitive domain operations produce micro effects in terms of persuasion, confusion, alienation, distortion, confusion, division, deterrence, etc., and cooperate with macro combat plans. Therefore, every macro and micro cognitive domain operation has strict timing requirements. It is closely related to the course of war in the physical, information and social domains, and is directly linked to the effects of war. In particular, it influences and coordinates with the war in the physical domain, and has obvious timing.

Intelligence. At present, the form of cognitive domain warfare has evolved from the past pure unilateral ideas, overall fuzzy judgments, difficult to accurately deliver, and subjective effect evaluation of public opinion warfare, psychological warfare, and legal warfare to the stage of cognitive domain warfare that can be accurately calculated, scientifically modeled, accurately delivered, and intelligently evaluated. Through social relationship modeling, content influence modeling, social cultural psychological cognitive modeling, and social behavior modeling to find the target audience, use the collected real-time big data, use powerful supercomputing centers, and use optimization and iteration including deep data mining, machine autonomous learning, and countless algorithm models to finally generate a smart social map of cognitive domain warfare for specific real objects. Current technology, computing power, and computing methods have been able to establish a network smart society for the physical society, and form a dynamic picture of the smart society based on the specific performance of the physical society; they can also promote the integration of the physical domain, information domain, social domain, and cognitive domain based on the system evolution of the real physical society in various complex situations. Intelligence has made the current cognitive domain warfare move towards a more high-dimensional, high-end, and high-tech development stage. The use of a large number of intelligent systems, equipment and technologies, such as intelligent robots, intelligent text, painting, discourse and other systems, and especially the birth of large language intelligent models, have pushed cognitive domain operations into a revolutionary intelligent era.

**The Realistic Basis and Evolution of Cognitive Domain Operations**

Cognitive domain warfare has actually existed for a long time, but people did not realize it at first. In the wars of primitive society and the two world wars that followed, public opinion warfare was widely used. The discourse of attacking the heart and soul, alienating and winning over, and intimidating and deterring are closely related to the current cognitive domain warfare. The psychological warfare used in the First World War and widely used in the Second World War also has a lot of similarities with cognitive domain warfare. Its fundamental purpose is to achieve the maximum effect of disintegrating, yielding and surrendering the other side at the lowest cost, that is, to defeat the enemy without fighting. After the Second World War, the war form based on public opinion warfare, psychological warfare and legal warfare gradually received attention among military powers and was actually used. Especially during the Cold War between the United States and the Soviet Union, in order to compete for world hegemony and sphere of influence, the United States and the Soviet Union carried out public opinion warfare, psychological warfare and legal warfare around the world, and psychological warfare was a more common means.

At the beginning of the 21st century, the idea of ​​"three wars in one" of public opinion warfare, psychological warfare and legal warfare was still popular (Yang Ming, 2005). It was not until the 2020s that the concept and idea of ​​cognitive domain warfare emerged with the development of cognitive science, artificial intelligence and emerging social media. There are two reasons for this.

On the one hand, the rapid development of cognitive science and other fields has provided theoretical preparation for cognitive domain operations. "Cognition" means knowing and understanding. It comes from cognitive psychology established in the 1970s. It refers to the whole process of the human brain's perception, attention, input, memory, thinking, judgment, problem solving, and information output of external information (Neisser, 1967; Solso; MacLin; MacLin, 2006). It is the basic function of the human brain and the abstract operation process of the brain based on the basic characteristics of external things. It shows strong subjectivity and preference. Human cognition often forms the prototype cognition of the individual category of things on the basis of embodied experience, and thus establishes more advanced cognitive principles and pictures of the movement, relationship, and complex relationship of things, and then produces cognitive preferences and cognitive habits, which are commonly referred to as prototypes, stereotypes, cognitive schemas, cognitive styles, conceptual metaphors, cognitive patterns, cognitive frameworks, etc. (Ungerer; Schmid, 2001; Croft; Cruse, 2004). In recent years, with the rapid development of cognitive science, people have made unprecedented progress in the field of cognitive neuroscience research. For example, people have discovered that the deepening and expansion of the understanding of things is to expand the connections between brain neurons and circuits. Every expansion of cognition enriches the connections between brain neurons, and the number of neuronal circuits increases. Since the 21st century, people's research on brain nerves has expanded to brain-computer interfaces, and will be further deepened to the point where they can input commands to the brain and complete behaviors under the guidance of commands by implanting chips into the brain. The development of cognitive science has provided unlimited possibilities for understanding, controlling, and controlling the brain, and has also created theoretical imagination space for cognitive domain operations.

On the other hand, the rapid development of modern computer technology, network technology, communication technology, media technology, language technology, etc., especially the continuous optimization of big data, natural language processing, data mining, etc., has greatly improved people's technology and ability to collect and influence data for every audience in society, and can also deliver information accurately to each specific audience, thus providing preparation for the space and multi-party conditions for cognitive domain operations.

Specifically, before the emergence of cognitive domain warfare, people also experienced a stage of information warfare. After von Neumann invented the computer in 1946, the ARPANET, a local computer interconnection, was born soon, and the primary Internet that continued to expand was born. After the 1990s, with the rapid development of computer technology, especially Internet technology, human society began to enter the Internet era of wide-area interconnection, and humans also entered the information society era dominated by information technology, and the form of war also moved towards informatization. During this period, information became the main object of war. Information technology and information means, including information platforms and information capabilities, especially the degree of informatization, digitization, interconnection, and standardization of various military services directly determined the dominance of war. Whoever can achieve accurate perception and collection of information, smooth transmission of information, high integration and processing of information, and confidential distribution and reception of information will grasp the initiative of information warfare and win the war. Therefore, the winning mechanism of information warfare lies in the control of the dominance of information: first, to ensure the smooth and secure communication in the electromagnetic fields of land, sea, air and space; second, to be able to safely receive and transmit information from the electromagnetic fields of land, sea, air and space under anti-interference conditions. The complete combat link can always operate safely and smoothly, and the initiative and dominance on the battlefield can naturally be guaranteed.

Highly informationized wars place higher demands on a country's ability to quickly acquire and centrally process large-scale information and data on the battlefield, as well as its computing power, algorithms, and every possible object that can be affected. Whoever can master more data, has the computing power to process huge amounts of data, and can provide accurate algorithmic solutions to data processing problems will have the initiative on the battlefield.

Since the 21st century, especially since the 2020s, big data, cloud computing, chip technology, intelligent technology, Internet technology, including emerging media and new algorithms have developed and evolved rapidly. In this process, on the one hand, people can store a large amount of data of the whole society through a large amount of memory; on the other hand, due to the widespread application of large-scale integrated circuit technology, human computing power has increased rapidly. As predicted by Moore's Law, the speed of computer operation will double every 18 to 24 months. At present, the computing speed of an ordinary computer is 100,000 to 1 million times faster than that of early computers. The emergence of a large number of computing centers and supercomputing centers has made it possible to realize endless computing and move towards the development path of endless frontiers; at the same time, with the rapid development of artificial intelligence technology, people can carry out deep social computing and cognitive computing through natural language processing and complex system modeling, especially neural network computing technology, and combine social, psychological, cognitive and behavioral ideas, so as to continuously improve, iterate and enhance algorithms and solve algorithm problems that could not be solved well in the past. Based on large-scale data, infinitely improved computing power, and constantly improved algorithms, artificial intelligence technology has been able to collect data on various forces in the whole society during the war, including the social group as a whole and each individual in a specific group, and to mine, clean, and optimize the huge amount of data in the past decade. In addition, it can also realize individual modeling based on big data, especially the behavior modeling of various groups based on culture, psychology, and cognition, so as to realize data control and behavior prediction of all people in society, including the realization of individual and group portraits and behavior prediction of specific groups based on network data.

Therefore, the storage, collection and computing capabilities of human beings for network data have generally improved, making it possible to perceive, acquire, store, calculate and model the data of all users involved in various social media in the entire network, and on this basis to achieve intelligent management and decision-making, as well as the understanding and influence of the cognition of groups and individuals. At present, combatants can push precise and purposeful information to the audience through a large amount of data analysis and the generated multi-dimensional information, thereby achieving cultural, psychological and cognitive influence on specific groups and individuals.

It can be seen that cognitive domain warfare is a new form of warfare that has emerged with human exploration of cognitive science. It has gradually developed on the basis of early public opinion warfare, psychological warfare, legal warfare, and recent information warfare. The fundamental reason for the emergence of this form of warfare is that computing data, computing power, and computing algorithms have made great progress. In addition, a large number of online information dissemination platforms, especially the emergence of online social media, have provided a combat platform and implementation path for cognitive domain warfare. This development path profoundly reflects that the rapid development of science and technology has provided endless frontiers and unlimited imagination possibilities for cognitive domain warfare.

**Strategic layout and practice of cognitive domain operations for major powers and regional organizations**

The origin of the concept of cognitive domain operations. The concept of cognitive domain operations has not been proposed for a long time. When people talk about the source of cognitive domain operations, they can't help but mention the American strategist John Boyd. In the 1970s, influenced by Clausewitz's ideas, Boyd proposed that all human conflicts can be summarized into three types: attrition warfare, mobile warfare, and spiritual warfare. He thus proposed the famous "OODA" (Observation-Judgment-Decision-Action) theory. The spiritual warfare he proposed has a certain connection with the current cognitive domain operations, but due to the constraints of the technical conditions at the time, cognitive warfare still remained at the level of psychological warfare, public opinion warfare, and political warfare (Boyd, 1996; Emily; Zac; Sian, 2018).

The real source of the concept of cognitive domain should be the concept domain or cognitive domain of different concepts in cognitive linguistics. Cognitive linguists George Lakoff and Ronald Langacker mentioned it in their literature in the 1980s (Lakoff; Johnson, 1980; Lakoff, 1987; Langacker, 1987/1991). Since then, this concept has been generally accepted in the fields of cognitive linguistics and cognitive science. It was not until the beginning of the 21st century that this concept was formally established in the military field. In 2001, the U.S. Department of Defense issued the report "Network-centric Warfare" (Carrica, 2001), which first mentioned that the cognitive domain is an independent combat space for information warfare. In 2006, the "Joint Information Operations Directive (JP3-13)" issued by the U.S. military has listed the cognitive domain as the most important dimension among the three dimensions of physical domain, information domain and cognitive domain. In 2008, Stuart A. Green, a U.S. Navy officer, pointed out in a paper analyzing the threats facing the U.S.-Israel alliance that the U.S.-Israel alliance faces a new form of combat, cognitive warfare, which targets the cognitive field, especially brain concepts, combat will, thoughts and ideology, and analyzed its elements and forms (Green, 2008). In September 2017, David L. Goldfein, former Chief of Staff of the U.S. Air Force, pointed out that "the form of war is changing from a war of attrition to a war of cognition", which marks that "cognitive warfare" has officially entered the U.S. military theoretical system. This concept is also regarded as the ideological core of the new round of U.S. military operational concept innovation (Emily; Zac; Sian, 2018). Since then, cognitive domain operations have entered the U.S. military terminology system as a mature concept. For example, the training directive "The U.S. Army in Multi-Domain Warfare 2028" (Todd Schmidt, 2020) issued by the U.S. Army in December 2018 clearly defines how the U.S. Army should conduct cognitive warfare with its opponents through means such as "competition, infiltration, disruption and exploitation" in future conflicts. It can be seen that cognitive domain warfare has become the basic style setting for the U.S. military's external operations.

The United States. As a country that is keen on "selling" war, the United States has always pursued the implementation of a variety of war styles abroad. In addition to the physical war full of gunpowder, the United States has also promoted a variety of multi-domain war styles to cooperate with the physical domain operations. These fields seem to be without gunpowder, but they have become an important part of the United States' external promotion of cognitive domain operations. The main means include economic sanctions, diplomatic containment, alliance isolation, military deterrence, financial looting, stigmatization of countries, alienation of the people, polarization of emotions, color revolutions, etc. It can be said that during the Cold War, the Cold War thinking and strategic measures promoted by the United States against the Soviet Union were completely a thorough practice of cognitive domain operations, which accumulated important experience for the United States' cognitive domain operations. After the Cold War, especially since the beginning of the 21st century, the United States has become more familiar with cognitive domain operations. Under the guidance of cognitive domain operations thinking, it has widely mobilized resources and forces to carry out cognitive domain operations in a high-profile manner around the world to further maintain and strengthen its hegemony. The specific manifestations are as follows.

(1) Frequently announcing strategies and implementing cognitive blackmail. In order to demonstrate the strength of their own power, the U.S. government, military, and think tanks have been loudly promoting their own important development strategies and research reports, showing the future development goals, force deployment, and positioning of the U.S. and U.S. military, thereby promoting American values. These mainly include the U.S. National Security Strategy Report, the U.S. National Science and Technology Strategy Report, the U.S. National Intelligence Strategy, the U.S. Indo-Pacific Strategy, and the U.S. Space Strategy. The U.S. military has been constantly announcing new concepts such as “Air-Sea Integrated Warfare,” “Network-Centric Warfare,” “Mosaic Warfare,” and “Island-Hopping Warfare.” With the advent of the intelligent era, the United States has been loudly displaying its artificial intelligence capabilities and development achievements through various channels, claiming to fight a war that “the opponent cannot understand.” The U.S. government and military have been using the endless emergence of new concepts and the endless frontier of scientific and technological development to loudly promote strategic-level cognitive domain warfare. Their fundamental purpose is to maintain the United States’ “cognitive hegemony” over people’s brains and minds around the world, thereby serving to maintain its global hegemony.

(2) Targeting China and Russia to create cognitive bias. In the process of promoting cognitive domain operations abroad, the United States mainly deliberately creates non-existent external threats through the promulgation of a series of major texts and the release of important information, in order to find reasons for expanding military spending, selling arms, and maintaining military power. In addition to the regular release of the National Intelligence Strategy, the National Four-Year Defense Assessment Report, the Military Power Report of Related Countries, and the Democratic Status Report of Related Countries mentioned above, information is also released through channels such as government and military press conferences, information published on important newspapers and websites, and interviews with important figures. In addition, the United States' cognitive domain operations also include stigmatizing external countries, or rationalizing its hegemonic behavior and serving its foreign policy by creating topics and forming bills. A typical example is that during the COVID-19 pandemic, some American politicians attempted to shift the blame for the pandemic to China; on the issue of the Ukrainian crisis, China was neither a party to the incident nor the perpetrator, but the United States repeatedly accused China and demanded that China take responsibility; it also promoted the "China Threat Theory" and "China Colonial Theory" through various channels around the world, etc. As for Russia, during the Ukrainian crisis, the United States exaggerated the Russian threat, exacerbated tensions, and fanned the flames and imposed extreme sanctions, which led to the expansion and prolongation of the crisis and created the largest geopolitical crisis in Europe since the Cold War.

(3) Strengthen alliance relations and form cognitive containment. In order to promote the formation of a good cognitive domain combat situation on a global scale, the United States, on the one hand, has launched the "Indo-Pacific Strategy" in a high-profile manner, built an alliance system around the world, and strengthened its global leadership. It also attempted to implement multi-party containment on its opponents by uniting allies, thereby forming high pressure from the cognitive perspective. First, in addition to the traditional NATO, the United States has strengthened US-ROK and US-Japan relations in the Asia-Pacific region, attempting to build a new triangular relationship between the United States, Japan and South Korea; on the basis of the Five Eyes Alliance, it has built the "Trilateral Security Partnership" (AUKUS) between the United States, Britain and Australia; and has won over India, Japan and other countries to create a "Quadrilateral Mechanism" between the United States, Japan, India and Australia. Secondly, it has put pressure on relevant countries by holding thematic and regional meetings, such as the "Democracy Summit", the "US-Africa Leaders Summit", and the "US-Pacific Island Summit". In addition, the United States has also attempted to strengthen bilateral relations, establish more extensive military bases in third countries, and encourage third countries to increase investment in relevant regions to offset the influence of relevant countries.

(4) Proclaiming technological progress and demonstrating cognitive oppression. Thanks to the large number of talents gathered after World War II, long-term stable development and high-level investment, the United States has always been a global leader in the field of high technology. For this reason, it is not surprising that the United States has made many achievements in this field. In recent years, most of the Nobel Prize winners in economics, physics, chemistry and other fields are from the United States. In addition to the United States' strong scientific and technological strength, another important reason is that under the influence of its hegemony, the United States attempts to use this platform to show its technological leadership in a high-profile manner, thereby shaping the United States' psychology and cognition at the forefront of science and technology. At the same time, the United States has also continued to show its important progress in the fields of artificial intelligence, human-computer networking, brain-computer interface, etc. For example, DeepMind, a subsidiary of Google, has repeatedly demonstrated its AlphaGo game against human chess players and won; Boston Dynamics has continuously demonstrated its research progress in robots on social media, trying to strengthen its leading position in the field of artificial intelligence; the high-profile display of rocket recovery technology, Starlink project, and ChatGPT, a general large model language technology developed by OpenAI, an American artificial intelligence company, on Internet platforms has attracted widespread attention from the world. The endless frontiers of science were vividly demonstrated by the United States in the cognitive domain operations in the field of science and technology.

(5) Battlefield combat application promotes cognitive evolution. From the end of the 20th century to the 21st century, the United States has continued to provoke multiple wars. From leading NATO to intervene in military operations against the Federal Republic of Yugoslavia, to the Afghanistan War, the Iraq War, and the Syrian War, the United States has also intervened in the Libyan Civil War, the anti-terrorism war against the Islamic State (ISIS), the Ukrainian crisis, etc. In this series of wars and conflicts, the United States has promoted cognitive domain combat operations into battlefield practice. In the war against the Federal Republic of Yugoslavia, the United States launched a computer war and quickly controlled the Federal Republic of Yugoslavia's network. In the Syrian War, the United States took advantage of the turmoil of the Arab Color Revolution to incite division among the people. In the current Ukrainian crisis, in addition to providing weapons to Ukraine in the physical space and technical support to Ukraine in the cyberspace, the United States has also provided Ukraine with tremendous support in the cognitive space and carried out extreme cognitive attacks on Russia in the following aspects: moral blame, political power condemnation, diplomatic group isolation, economic blockade and sanctions, Internet isolation, interruption of cultural and artistic exchanges, and implantation of intelligent technology, etc. It can be seen that the United States has advanced cognitive domain warfare to the level of multi-domain warfare, hybrid warfare, and full-domain warfare in actual combat. It is very skilled in the application of strategy and tactics, and continues to use technology and multi-domain warfare methods to exert extreme suppression on its opponents.

North Atlantic Treaty Organization. After years of development, NATO now has more than 30 member states. The NATO Convention stipulates that when any of the contracting parties is attacked by armed force, it should be regarded as an attack on all the contracting parties. This convention itself contains the meaning of cognitive domain operations. From the day it was born, NATO mainly targeted the then socialist camp, the Warsaw Pact, and carried out cognitive domain operations in the form of the Cold War. After the upheaval in Eastern Europe, NATO has actually lost its basis for existence, but it has taken advantage of the upheaval in Eastern Europe to continue to expand eastward, pointing its spearhead directly at Russia. Since the birth of the concept of cognitive domain operations, NATO has attached great importance to the research and specific application of its combat mechanism, and promoted related strategic deployment and practice.

(1) Actively conduct research and share research results. NATO has a strong interest in cognitive domain operations within its organizations. In order to gain an advantage in this field, it has actively conducted relevant research. On June 21, 2021, the Innovation Center of NATO's Allied Command Transformation (ACT) and the French National Institute of Cognition-Ecole Nationale Supérieure des Ingenieurs Cognitifiques (ENSC) jointly organized a high-level seminar on "cognitive warfare" at the ENSC in Bordeaux, France. A group of scientists, military and industrial stakeholders, and representatives of the innovation center attended the meeting. The meeting conducted in-depth discussions on the definition, connotation, expression, means, theory, core technology, network role, narrative, and many other contents of cognitive domain operations. The meeting summarized the complexity and simplicity of cognitive domain operations, demonstrated the framework, social culture, cognitive behavior, and technology empowerment in cognitive domain operations, and shared experiences with NATO member states by presenting and analyzing important cases. It also summarized the origins of cognitive domain operations and their differences from other traditional forms of warfare (Claverie; Prébot; Buchler; Cluzel, 2021).

(2) Focus on Russia and build a Western camp. Influenced by the United States, NATO’s spearhead is directly aimed at Russia in the field of cognitive domain operations, while shaping NATO’s overall image. In shaping and disseminating Russia’s image, NATO has effectively developed a biased narrative. On the one hand, it has created its own image of a victim; on the other hand, it has transmitted a fear of Russia to countries in the region. Under the influence of this psychology, NATO, an international organization composed of 12 countries, has gradually developed into a collective security organization composed of more than 30 countries. In the Ukrainian crisis, NATO also strongly supported Ukraine and isolated Russia. It imposed sanctions on Russia in the fields of politics, economy, diplomacy, and cultural exchanges. In the military, it maintained a high-pressure posture against Russia, continuously deployed missiles in areas near the Russian border, conducted military exercises, and even secretly dispatched military personnel, including combat personnel and senior advisers, to participate in the Ukrainian army’s operations against Russia. In terms of cultural exchanges, it banned Russia’s social networking platforms, invaded Russian websites in cyberspace, alienated, divided, and westernized Russian citizens, and weakened their national identity, cultural identity, and military spirit. Under the influence of the United States, NATO has become the vanguard of cognitive domain operations against Russia in the current Ukrainian crisis.

Russia. Russia is geographically close to the West and has a deep historical connection with it. Whether in the Napoleonic era or during the two world wars, Russia was in a struggle with the West in different states. During the Cold War, the Soviet Union and the Western camp launched a global confrontation and competition. From now on, an important reason for the Soviet Union's failure in the Cold War was its failure in the cognitive domain battle with the Western camp led by the United States. Russia's current cognitive domain battle has the following main characteristics.

(1) The official mainstream media takes the lead, and other media actively cooperate. Russia has always emphasized speaking out through the mainstream media and using the mainstream media to unify its voice. Russia mainly uses ITAR-TASS (Russian News Agency), Voice of Russia, Russian News Agency, Interfax, Channel One, and RIA Novosti to convey a unified voice to the outside world, while other media organizations convey the voice of the mainstream media. During the Ukrainian crisis, Russia promulgated a law stating that other media must quote reports on the Ukrainian crisis from the Russian mainstream media. For some media that violate the regulations, the Russian authorities will impose corresponding fines or restrict and shut down. The Russian Ministry of Defense regularly publishes the progress of the war for media to reprint.

(2) Leaders use grand narratives to seize the humanitarian and moral high ground. In order to gain the moral high ground and initiative in the war, especially the right to define the war, and to fight back against Ukraine and the West's stigmatization of Russia and the blocking of discourse platforms, Russian President Vladimir Putin has made many speeches to the whole of Russia and the world. In his speeches, Putin made an in-depth analysis and interpretation of the Ukrainian crisis, pointing out that this was a special military action by Russia, a response to NATO's long-term deception, and an effort to achieve demilitarization and de-Nazification in Ukraine, and to keep Ukraine neutral and protect the proper status of the Russian language. In his speeches, Putin also repeatedly emphasized that Russia and Ukraine share the same origin and ethnicity, and that Russia has no intention of occupying Ukraine. At the same time, the Russian Foreign Minister has made many visits to international organizations and countries, including the United Nations, to speak out for Russia and to offset the negative voices of Western countries as much as possible.

(3) Actively adopt smart technology and make use of other channels to speak out. In the early stages of the Ukrainian crisis, Russia released statements favorable to Russia through Russian Television (RT), Russian social platform (VK), Twitter, Facebook, Instagram, Google search engine, etc., creating a proactive atmosphere for Russia's military operations. After Russia's main social media was disconnected or isolated from the international community, it made more use of the above social platforms to continue to release information favorable to Russia in the third world.

(4) Hybrid multi-domain operations, maintain composure. The Ukrainian crisis itself is a cognitive domain operation. After the military operation began, Russia began to prepare for multi-domain operations in the fields of politics, cyberspace, finance, diplomacy, energy, food, and humanitarianism, as well as hybrid operations that alternated between military operations and civilian operations. Russia and the West simultaneously launched an open war in the physical space, a covert war in the cyberspace, and a support war in the cognitive domain. Overall, Russia's cognitive domain operations are mainly influenced by the hybrid warfare theory proposed by Gerasimov, showing a strong Russian characteristic. Russia's hybrid warfare thinking was applied in the Crimean War and achieved obvious results (Pocheptsov, 2018). Throughout the Ukrainian crisis, in addition to military operations, Russia and the West, led by the United States, competed for cognitive initiative in many fields, including the humanitarian truth of the "Bouchard Incident", the bombing of the "Nord Stream" pipeline, the narrative of transporting weapons during the conflict, the Ukrainian refugee crisis, and the issue of Sweden and Finland joining NATO. Russia's hybrid multi-domain cognitive domain struggle has effectively coordinated its own physical domain operations.

**Main theories of cognitive domain operations**

As an emerging field, cognitive domain operations do not have a fixed and unified theory. The "conquer the enemy without fighting" in "The Art of War" can be said to be the most important idea. In terms of subject areas, the theory of cognitive domain operations first comes from the field of cognitive science, including cognitive neuroscience, cognitive behavioral theory, cognitive cultural theory, cognitive thinking theory and other fields. At the same time, it will continue to involve theories in other fields, forming a trend of continuous enrichment and continuous convergence. With the introduction of a large number of neurocognitive devices such as electroencephalograms (EEG, ERP), functional magnetic resonance imaging (FMRI), and eye trackers, people's understanding of brain cognition has become more and more in-depth and comprehensive. Therefore, the theory of cognitive domain operations is in a stage of continuous enrichment and development, showing the characteristics of multi-disciplinary, multi-field, and multi-dimensional.

As mentioned above, in the formation and expression of cognitive concepts alone, cognitive domain operations involve many concepts and theories such as cognitive categories, cognitive embodiment, conceptual metaphors, cognitive windows, cognitive styles, individual cognition, group cognition, identity, cultural identity, and cognitive context (Ungerer; Schmid, 2001; Glass; Holyoak, 1986); from the field of communication, we can also introduce concepts and theories such as the spiral of silence, agenda setting, mob, first communication, truth problem, emotional problem, repetition, information island, and information cocoon (Miller, 2007; Liu Hailong, 2008; Ouyang Hongsheng et al., 2020); in the field of literary narrative, there are also theories such as grand narrative, micro narrative, cognitive narrative, multidimensional narrative, conflict narrative, and emotional narrative. In the field of media, we can absorb theories such as media convergence and multimedia multimodal fusion reporting. In terms of style, there are also theories such as multi-genre mixing and multi-discourse intertextuality (Smed et al., 2021; Ouyang Hongsheng et al., 2020). In addition, intelligent technologies and theories such as character and group portraits, character and group psychological analysis, character and group psychological cultural cognition and behavior analysis, social culture and behavior analysis, human-computer interaction theory, and brain-computer interface interaction theory can also be applied to cognitive domain operations (Woolley; Howard, 2019; Auerbach; Castronovo, 2013; Cambie; Ooi, 2007).

In short, due to the complexity of cognitive domain operations, cognitive domain operations theory also presents rich diversity, multidisciplinary and interdisciplinary nature. With the further deepening and extension of cognitive domain operations, its theoretical system will be further refined and complete, and its development direction will more prominently reflect the characteristics of the field of cognitive domain operations.

**Core technologies of cognitive domain operations**

The huge difference between cognitive domain operations and traditional public opinion warfare and psychological warfare is that cognitive domain operations have a strong technical background and technical support. Traditional public opinion warfare and psychological warfare often can only make fuzzy judgments due to the lack of prior understanding of each potential impact object, especially the lack of understanding of the cognitive preferences, cognitive defects, cognitive shortcomings, cognitive blind spots, cognitive styles, cognitive levels and overall cognitive characteristics of the relevant objects. On this basis, fuzzy instructions and executions are implemented for combat operations, and it is difficult to make a clear assessment of the results, that is, it is impossible to form a clear loop of the "observation-adjustment-decision-action" cycle (OODA). At present, due to the rapid development of technology and algorithms, the extension of technical platforms to the forefront, and the realization of ultra-large-scale centralized storage of information resources, the technical capabilities of cognitive domain operations have been upgraded to a state of unlimited rapid development. In addition, the design and generation of information products, the diversity of generated content, the precise delivery, transmission and dissemination mode of products, and the impact of information products have all surpassed any previous era. Human cognitive domain operations have truly entered an era of rapid development of technology and cognition.

In brief, the technologies in the field of cognitive domain combat can be roughly divided into the following main types.

General technology. This mainly refers to the general technology of cognitive domain operations, that is, the technology and skills that people can make cognitive domain operations products in the absence of special intelligent equipment, which generally include the production and printing technology of general books, newspapers and other paper publications, photo photography, radio broadcasting, television, film photography and production. This type of technology can also include some skills, such as design art skills, painting, rap, performance, dance and other skills. These general technologies and skills are the basic capabilities of cognitive domain operations and are widely applicable to traditional cognitive domain operations (Lu Shuming and Hong Junhao, 2007; Zhang Lei, 2008; Auerbach; Castronovo, 2013; Jason, 2015; Liao Dongsheng et al., 2021).

Emerging technologies for cognitive domain operations. With the development of natural language processing, big data, cloud computing, and artificial intelligence technologies, especially the emergence of intelligent technologies for multimedia, multimodality, and multiple fields, current cognitive domain operations have entered a new stage of development. Cross-cultural, cross-language, and cross-field cognitive domain operations are relatively easy to achieve. These technologies include: (1) Information situation awareness and monitoring technologies: multilingual information analysis and monitoring technologies, multimodal information perception and analysis technologies, target information extraction and knowledge mining technologies, multicultural perception and immersion analysis technologies, public opinion monitoring and response technologies, cognitive emotion computing technologies, cognitive profiling technologies, knowledge graph technologies, etc. (2) Information generation and application: multilingual translation technologies, intelligent modeling technologies, intelligent code writing technologies, intelligent text recognition and generation technologies, intelligent image generation technologies, intelligent speech technologies (recognition and synthesis), intelligent video generation technologies, etc. (3) Information delivery and dissemination technologies: electromagnetic space insertion technologies, emerging social media intervention technologies, virtual reality technologies, augmented reality technologies, mixed reality technologies, etc. (4) Deep fake information generation, verification and authentication technology: intelligent deep fake and automatic generation technology, intelligent information tracing and transmission path backtracking technology, multimodal (text, voice, picture, video) information authenticity authentication technology, etc. (5) Intelligent robot technology: intelligent voice response technology, intelligent image service robot technology, intelligent video service robot technology, intelligent news article writing robot technology, intelligent multimodal information generation service robot technology, specific field intelligent robot technology, military struggle individual cognitive domain combat information transmission robot technology, etc. (Kott, 2008; Ray Kurzweil, 2011; John Blakeman, 2019; David Sapt, 2020; Liao Dongsheng and Guo Qin, 2022).

Potential technologies for cognitive domain warfare. At present, cognitive domain warfare has entered the development stage of immersive, experiential, creative, and situational cognitive scenario exploration. A series of new concepts, ideas, and creativity are constantly emerging. Although many of these technologies are still in the exploration stage or are not mature enough, they have strong potential application value in the future. These include: (1) Metaverse. Metaverse is widely used in the creation of some animation games, creative novels, and historical and cultural scenes, and can generate extremely attractive virtual scenes and mixed scenes. (2) "Brain control" technology. A large number of experiments have verified that the human brain can be deeply affected by external infrasound waves, electromagnetic waves, lasers, emotional voices, dense noise, stimulating images, etc., leading to loss of combat function; it can also maintain a long-term awake and non-fatigue state under the influence of some specific drugs; in certain circumstances, if the activity rhythm of the brain can be mastered, specific instructions can be issued to make soldiers refuse to execute orders from superiors and surrender voluntarily. (3) Brain-computer interface technology. This is an area that countries are currently paying close attention to and investing heavily in. The research goal of brain-computer interface is to implant chips in the human brain so that people can execute instructions from a remote network. At present, scientific research has proven that by implanting electrodes into the brains of animals, animals can perform some simple actions. Looking to the future, research in this area will also show unlimited possibilities. (4) Individual perception and response technology. The current individual perception and response are completely based on the basic perception ability of human beings. In the future, human perception ability can be fully amplified in various fields, such as the perception of sounds of different frequencies, lights of different spectra, and information at ultra-long distances, as well as the comprehensive integration of various information and its response and decision-making. The individual perception and response system will be able to apply a large number of artificial intelligence technologies to shape a super individual soldier, whose ability in the cognitive domain combat field will be unlimited. (5) Large model content generation technology. At present, this type of technology has actually been produced and partially verified, and has received a good response in reality. With the widespread emergence of general large-scale model technology in artificial intelligence, content generation technology based on general large-scale models will have a profound impact on cognitive domain operations and push the technological development of cognitive domain operations to another new frontier (Du Yu and Zhang Ziming, 2023; Luo Yuyan et al., 2018; Zhao Guodong, Yi Huanhuan, and Xu Yuanzhong, 2021; MWI Staff, 2022; Giordano, 2022).

The technology of cognitive domain operations, like the theory, has no end and no boundaries. At present, a series of new technologies in new domains will bring new impacts to the cognitive domain, such as Starlink technology, quantum communication technology, cognitive domain operations multi-domain intelligence acquisition and analysis technology, multi-domain global intelligent command and deduction technology, etc. These technologies are placed at the strategic level in joint operations, but their emergence and rapid development will further strengthen the rapid progress of the concept, style, and tactics of cognitive domain operations, and promote the leapfrog development of cognitive domain operations as a whole.

Cognitive domain operations are a great test of the cognitive domain, a deep self-questioning and subversion of the cognitive domain, and a deep expansion and reconstruction of the cognitive self-limit. At present, with the rapid development of cognitive science, people's in-depth exploration of the endless frontiers of the cognitive domain, and bold breakthroughs and integrated innovations in cognitive domain theory and technology, the endless frontiers of cognitive domain operations will only move to a more advanced, frontier, and frontline.

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Warfare Capability of Cognitive Domain: An Overseas Observation

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**Abstract:** With theories of modern cognitive science and various cutting-edge technology and means, cognitive warfare strives for influencing the views, attitudes, ideas, and standpoints of the targets upon which cognitive influence and cognitive shaping are imposed, so as to better promote the cognitive warfare models and patterns. The USA, NATO, Russia, etc. have had abundant strategic deployments and practices with diversified characteristics in the cognitive warfare, demonstrating the pursuit of endless frontier technology and theory in the cognitive warfare. With the advancement of related technology, the cognitive warfare technology and theory of these countries and international organizations will be further enriched and extended.

**Keywords:** cognitive science, cognitive warfare, cognitive theory, cognitive technology