**Cognitive domain: from habitual to human-machine interaction**

Source: People's Forum Academic Frontier, June 2023

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2023-06-25

<https://www.rmlt.com.cn/2023/0625/676345.shtml>

【Abstract】The cognitive domain is not a well-defined academic concept, but a multidisciplinary field formed around the exploration of human cognition. Based on the intersection of multidisciplinary exploration practices, we believe that the focus of the cognitive domain is on four interrelated areas: information acquisition, information processing, cognitive formation, and cognitive influence. Historical and current practices have formed two extremes: the habitual patterned cognition facing familiar scenes and the non-patterned cognition facing unfamiliar scenes. With ubiquitous connectivity as the premise, digital technology represented by artificial intelligence has, on the one hand, brought about rapid changes in society, promoted the development of cognitive scenes in the direction of constant alienation, and made non-patterned cognition the norm; on the other hand, it has rapidly interacted with cognitive science and produced machine intelligence that interacts with human cognition, which not only provides support for enhancing human cognition, but also provides opportunities for intervening in human cognition, directly leading to the failure of human cognitive independence, making the cognitive domain with cognitive influence as the goal the forefront of scientific competition and a new stage for great power games.

【Key words】cognitive domain, patterned cognition, human-computer interaction

【Chinese Library Classification Number】R318/TP18 【Document Identification Code】A

【DOI】10.16619/j.cnki.rmltxsqy.2023.11.002

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On the one hand, digital technology has brought humans into a highly interconnected era, creating one unfamiliar scene after another for human cognition; on the other hand, the role of machine intelligence in human interconnection is becoming more and more prominent, and its impact on human cognition is increasing day by day. In some fields, large-model machine intelligence represented by generative artificial intelligence (AIGC, such as ChatGPT) has become a key intermediary for human cognition, and is developing towards an intelligent entity that is parallel to the human subject, transforming the traditional "human-human" interconnected cognition into "human-machine-human" mutual cognition.

The impact of machine intelligence on humans is extensive and profound. From learning to work, from production to life, from social interaction to health, it is rapidly penetrating into all aspects of human beings from biological attributes to social attributes. In the cognitive domain, this penetration trend can be summarized as the diffusion and emergence from supportive penetration to dominant penetration. Supportive penetration refers to the breakthrough and extension of machine intelligence on the limitations of human sensory and physical abilities. Since the birth of technology, technology has continuously formed support for human abilities in its development, such as physical strength, regular actions, evidence-based deduction, etc. (Clark, 2001). However, before the birth of machine intelligence, the power that dominated human cognition was still limited to human relationships. For example, in the process of understanding nature and human beings themselves, the shift from conceptual debate to the identification of facts has realized the replacement of science for religion; in constraining human actions, the shift from violent conquest to consensus on rationality has realized the replacement of law for conflicting customs and cultures. The penetration of machine intelligence into cognition means the essential change of the impact of technology on humans, from the instrumental field of perception and physical extension to the cognitive field of thinking and consciousness intervention. Although machine intelligence has not yet completely replaced human cognition, it has already affected human perception, memory, thinking, language, imagination, and even overall cognitive activities in many fields, allowing the hidden cognitive domain to quickly surface, becoming the forefront of new technology competition and a new stage for great power games.

This article attempts to start from a multidisciplinary perspective on understanding the cognitive domain, and to understand the cognitive domain as a whole by characterizing the two extreme values ​​of cognitive domain practice; to sort out the historical context of the formation of cognitive domain problems, and to analyze the challenges brought about by the emergence of cognitive domain problems, so as to provide the knowledge context and cognitive premise for further exploration and analysis of the theory and practice of cognitive domain.

**A multidisciplinary perspective on understanding cognitive domains**

As a concept, although "cognitive domain" has been used in academic literature, different terms and meanings are used in different documents. It is generally believed that cognitive domain is a general term for human cognitive activities such as perception, thinking, and imagination. However, in academia, the reference to cognitive domain associations is too broad and rough. The connotations and extensions defined by different disciplines vary greatly, and there is no consensus in many aspects. In addition, cognitive domain is not a research topic with a clear focus. More often, when a discipline discusses a specific topic, cognitive-related issues are involved, and cognitive domains are used as auxiliary explanations. This situation occurs not only in academia, but also in the practical field of using cognitive domains.

In the academic field, the epistemic field of philosophy of science refers to the whole of scientific cognitive activities. For example, the epistemic field proposed by Mario Bunge is a general term for various knowledge acquisition activities. Bunge believes that the epistemic field is composed of people and communities engaged in cognitive activities, the overall philosophical view of the cognitive subject, specific domains and problem domains, original knowledge reserves, and the logical or mathematical tools used. When these elements meet certain conditions, they can be called the epistemic field of science (Bunge, 1983). Bunge's epistemic field is actually epistemology, which is concerned with how people acquire knowledge, how to acquire scientific knowledge, and how to distinguish between science and pseudoscience. From this, we can also understand that although the epistemic field is a common Chinese translation of many English terms, there will be subtle or even large differences between the meaning of the original term and the meaning of the Chinese epistemic field. For Bunge's epistemic field, it may be more accurate to use "epistemic field" to translate it.

The cognitive domain in cognitive linguistics is the cognitive framework for people to understand the meaning of language and is part of the information processing. Cognitive linguistics believes that language is understood through concepts, and each semantic unit gains meaning in a specific cognitive framework. Ronald W. Langacker pointed out that the cognitive domain is an interrelated and highly organized conceptual system that language evokes in people's minds (Langacker, 1987). For the cognitive domain we are discussing, it is a typical part of information processing. However, Langacker believes that the understanding and expression of a certain semantics often involves multiple cognitive domains, some of which come from universal experience (such as time, space, temperature, color, etc.), and some come from specific social, cultural or even personal experience (such as marriage, trade, politics, etc.). At this time, the cognitive domain is more like the patterned cognitive practice we will discuss later.

The cognitive domain of pedagogy refers more to cognitive skills, which are also part of information processing. Bloom's Taxonomy, proposed by Benjamin Bloom in 1956, divides teaching objectives into three areas: cognition, emotion, and action (Bloom et al., 1956). His cognitive domain covers the main skills for processing objective facts and information, including six levels: memory, understanding, application, analysis, evaluation, and creation. Before Bloom, research on adolescent cognitive development had basically framed the focus of the cognitive domain of pedagogy. For example, a series of works by Jean Piaget emphasized the relationship between educational activities and cognitive development, and also focused on cognitive processes and cognitive skills (Jean Piaget, 2009).

The cognitive domain of cognitive psychology focuses on the relationship between cognitive psychology, information processing, thinking and other processes and behavior. If psychological processes are excluded, cognitive psychology not only concerns information processing, but also involves the formation of cognition and cognitive influence. In terms of the history of the discipline, cognitive psychology is the product of reflection on behaviorism, and it is also an academic movement that pushes cognition as a specialized field to the forefront of academia. With the publication of Ulric Neisser's "Cognitive Psychology" as a symbol, cognitive psychology not only achieved great success in academic competition, but also truly established the foundation of psychology in the field of cognitive science. Subsequently, factors such as memory (such as George Miller, 1956), learning (such as Jerome Brune, 1960), and language (such as Noam Chomsky, 1965) were taken into consideration as important variables in the cognitive domain, which also pushed the study of cognition into the academic mainstream and promoted the emergence of cognitive science.

However, in cognitive science, the field of cognition is an overall field, referring to the research scope of multidisciplinary cognitive sciences. Cognitive science tends to regard the cognitive domain as a computational system that follows certain procedures and laws. It is a multidisciplinary collection dedicated to exploring the internal mechanisms of human acquisition, storage, exchange, processing, utilization, and reproduction of information, studying human perception, attention, memory, language, thinking, decision-making and other conscious activities, and then revealing human cognition, fitting human cognition, and recreating human cognition, such as neuroscience, cognitive psychology, natural linguistics, artificial intelligence, etc.

In summary, in the academic field, some studies use cognitive domain as an independent variable to explore the impact of cognitive domain on other phenomena, such as language acquisition and skill learning as information processing, and the impact of knowledge production as cognitive formation and cognitive influence on other factors such as human actions; the other part uses cognitive domain as a dependent variable to explore the biological process, psychological process, social process, etc. of cognition. It should be noted that although cognitive science has put cognitive domain on the academic stage, the multidisciplinary ambiguity of cognitive domain also shows that the academic community's discussion of related fields of cognitive science has not attracted enough attention to cognitive domain. What really makes people pay attention to cognitive domain is the exploration of cognitive domain in the practical field.

In the practical field, military practice has pushed the cognitive domain to the forefront of the war form. In the past, people assumed that weapons that are external to the human body are the basis for understanding the war form. For example, wars are divided into cold weapon wars and hot weapon wars based on weapons; and further classified based on the lethality, killing range, and projection distance of weapons. In addition, from ancient times to the present, although there are many classic cases of using psychological factors in war, "The Art of War" even regards "conquering the enemy without fighting" as the highest realm of war. However, in practice, psychological factors [1] are still only independent variables that affect the outcome of war, rather than the dependent variables expected by "The Art of War"; there is no precedent for incorporating the entire cognitive domain into the combat object.

At the beginning of the 21st century, a report submitted by the U.S. Department of Defense to Congress pushed the cognitive domain to the forefront of the war form in practice. In this report, U.S. military experts used cognitive domain to summarize the related factors of human perception, understanding, belief, values, decision-making and other cognitive fields. The purpose was not to expand the understanding of cognitive domain, but to include cognitive domain in the combat object. The report pointed out that in order to win the war, intervening in the cognition of the enemy and one's own side can become a combat strategy. The cognitive domain is therefore regarded as the third battlefield coexisting with the physical domain and the information domain. Strictly speaking, these three domains are not mutually exclusive, but the boundaries are very clear. Physical domain warfare refers to the use of any weapons and any tactics in the physical space. No matter what the target is, the physical space is the battlefield. Information domain warfare refers to the use of information as a weapon in any space. No matter what the target is, information is a weapon. Cognitive domain warfare refers to the use of cognitive models to influence people's emotions, psychology, will, beliefs, values, etc. through information feeding, intervene in people's cognition, and win the war at the cognitive level, that is, "conquering the enemy without fighting." Cognitive domain warfare is the development of information domain warfare. If information domain warfare is to intervene in people's psychology, then cognitive domain warfare is to further intervene in people's cognition, such as concepts, based on psychological intervention.

From the very limited literature, we can see that "cognitive domain warfare" has three main focuses. The first is information feeding. Using the most cutting-edge technology, a large amount of information that is difficult to distinguish between true and false is disseminated at an unprecedented speed and breadth to intervene in public opinion, guide emotions, and spread awareness, which is what people usually call information warfare. The second is psychological intervention. Taking human cognitive laws, cognitive defects, cognitive traps, etc. as the entry point, using precise digital portraits to silently feed information and shield information, etc., and then accurately and effectively intervene in people's psychology (Yu Yuanlai and Chen Qian, 2022), which is what people usually call psychological warfare. The third is cognitive intervention. Taking cognitive science conclusions as the entry point, using comprehensive technologies including brain-computer interface technology to intervene in people's perception, cognition, emotions, feelings, concepts, beliefs and other conscious activities, which is what people often call cognitive warfare. It can be seen from this that cognitive domain warfare is not a single war, but a war covering the entire cognitive domain of information acquisition, information processing, cognitive formation, and even cognitive influence, and it is a war aimed at winning cognitive recognition.

So far, the widespread use of the concept of cognitive domain is largely due to the complexity of human cognition and its related factors. When people talk about cognition, sometimes they refer to the concept of a specific object, sometimes they refer to thinking activities such as knowledge, beliefs, and decisions, and sometimes they may be expanded to the entire human consciousness. The meaning of each reference in a given context is clear and definite, but the meaning in the macro sense is vague. In this regard, one possible explanation is that scholars are still talking about cognition as a factor in their respective disciplines, rather than understanding cognition as a structural component of the entire cognitive domain; moreover, cognitive activities are only a part of human consciousness, not all of human consciousness. Despite this, we can still understand from the diversity of different disciplines, especially the frontier discoveries of cognitive domain practice, that the discussion of cognitive domain is inseparable from human cognitive activities, and human cognitive activities are inseparable from the process from information acquisition, input to cognitive output, and between input and output, they are inseparable from information processing. In this way, we believe that cognitive domain is a series of scientific and practical fields of human-information interaction through information acquisition, information processing, and cognitive formation to achieve specific cognitive effects.

**Two extremes of traditional practice in cognitive domain**

In the process of interaction between people and information, thinking is information processing and also a part of cognition. Many biological evidences show that as long as the human brain is alive, thinking continues and cognition is ongoing. Looking back on the past, we may have had such experiences. Sometimes, the brain works very fast, consumes a lot of energy, and the body feels very tired; at other times, the brain hardly works, does not consume too much energy, and the body feels relaxed. There are also times when it seems that you suddenly get enlightened, understand, and think clearly; more often, it is vague and unclear. If we understand the operation of the brain and thinking as cognitive activities, then what form does human cognition exist in? For example, is information acquisition and information processing homogeneous or non-homogeneous? Is cognitive formation and cognitive influence patterned or non-patterned?

Distinguish between fast and slow thinking. There are different starting points for the first question. We choose to start from cognitive domain practice. To this end, we can do a thought experiment. Assuming that the interaction between people and information is homogeneous, the conditions for satisfying homogeneous interaction must be that cognitive related practices such as information acquisition, information processing, cognitive formation, and cognitive influence are also homogeneous on the extension axis of time. However, an examination of daily life shows that we cannot find the fact that people and information interact homogeneously anyway. Our experience is that from information acquisition, information processing, to cognitive formation and cognitive influence, sometimes it is easy, sometimes it is difficult; sometimes it is confusing, sometimes it is clear, and it is not homogeneous.

Since it is not homogeneous, it means that there are rhythmic speeds. Daniel Kahneman's research shows that people do think fast and slow. Slow thinking refers to the thinking mode in which people conduct thoughtful, conscious analysis and reasoning when faced with complex and novel things or when they need to think deeply. Kahneman believes that slow thinking requires more cognitive resources and attention, and also involves specific methods such as logical reasoning, comparative analysis, and problem solving, so it is also more rational. Fast thinking refers to people's thinking that makes judgments and decisions quickly and automatically when faced with simple, familiar and intuitive things. Kahneman believes that fast thinking is intuitive, fast, and does not require a lot of cognitive resources. Fast thinking is also people's daily way of thinking, such as identifying objects, answering simple questions, and performing habitual behaviors (Daniel Kahneman, 2021).

We believe that Kahneman's thinking speed implies a premise, that is, whether thinking is patterned. For example, when encountering complex things, people have to make logical inferences, why? When encountering simple things, people will follow conventions, why? Combining the two "whys" into one question is, what are the conditions for choosing to make logical inferences or follow conventions? A common saying "practice makes perfect" may remind us that the speed of thinking is not necessarily because the things people face are simple or complex, but because of whether people are familiar with them. There is also a common saying to support this reminder: it is not difficult for those who know, and it is difficult for those who do not know. Familiarity or knowing means that you have encountered the same or similar things and have applicable cognition or solutions. Difficulty or not knowing means that you have never encountered the same or similar things and do not have applicable cognition or solutions. In other words, it is difficult to establish cognition when facing unfamiliar things; it is relatively easy to establish cognition when facing familiar things. We can even think that the speed of thinking has nothing to do with whether things are simple or not, but only concerns whether people can use patterned cognition.

To further clarify stereotyped cognition, let's take an example. The founders of anthropology created a method for collecting research data: field work. In the early stages of anthropology, the research object was usually the other society. The other means different from oneself and strange. The other society is a society different from one's own society (Robert Leighton, 2005). For anthropologists, difference means everything except that they are all human beings, from production and life to customs and culture. Among them, the most important difference is the difference in culture (social rule system). Anthropologists believe that if you can't understand the social rule system of the other society, you can't understand the other society. But to understand the other society, you must enter the other society and understand and practice the other culture like the other. On the one hand, given that every acquaintance society will trigger an early warning mechanism when facing strangers, it means that when anthropologists enter, they face the other society in a state of early warning, rather than the other's daily society. In order to observe the daily life of the other society, anthropologists have to spend time to let the other society accept themselves as outsiders. On the other hand, since anthropologists are not familiar with the culture of other societies, their cognition of other societies cannot be accomplished by quick thinking. This means that even when faced with simple things, they need to dig out from the practice of other societies. The first step is to find key events that can reflect the culture of other societies. To do this, it also takes time. The practice of anthropological field investigation methods tells us that when faced with unfamiliar other societies, even experienced anthropologists, even if they are familiar with the methods of entering the field, still need 6 months or more to enter the field. The reason is that anthropologists are familiar with the methods of entering the field, but the other society is not familiar with the anthropologists who are going to enter. If they are not familiar, they need to listen to what they say and observe what they do, and they need to think slowly. If they are inexperienced anthropologists, it will take a long time for the anthropologists and the other society to observe and understand each other, and they need to think slowly. Once both parties are familiar, the entry process can adopt quick thinking, but the anthropologists' research has to be slow because they are facing unfamiliar things.

Both thought experiments and specific cases tell us that in the interaction between people and information, Kahneman's speed of thinking only describes the speed of people's cognition, but does not give a clear explanation of the conditions for the speed of cognition. We believe that what affects the speed of thinking is not the simplicity or complexity of things, but whether people are familiar with things and whether they have corresponding patterned cognition. Familiarity leads to fast thinking; unfamiliarity leads to slow thinking. Simply put, there are two forms in cognitive domain practice, one is patterned cognition and the other is non-patterned cognition. Facing daily practice, we can find that the extreme value of patterned cognition is cognition that is integrated into daily habits, does not require thinking, and is dominated by the cognitive subject, that is, it is taken for granted; the extreme value of non-patterned cognition is cognition that is separated from daily habits, is not necessarily obtained even if thinking, and is even dominated by the environment, that is, the mind changes with the environment. The reason why the two are called extremes is that no cognition is completely patterned and completely integrated into habits, and no cognition is absolutely non-patterned and completely dominated by the environment. In practice, people always have cognition that is above a certain level between the two extremes.

Patterned cognition: getting used to it. In 2018, the theme of the 20th World Philosophy Conference hosted by Peking University was: Learning to become a person. Professor Lin Jianhua, then president of Peking University, emphasized at the opening ceremony of the conference that "the collision of philosophers' thoughts can promote us to think more deeply about important contemporary topics such as self, community, nature, spirit and tradition". Obviously, Professor Lin Jianhua regards the mutual communication among philosophers as a form of learning and understands the thinking of philosophers as cognitive formation. However, how can "learning" "become"? It is interesting to ponder that the problems that philosophers think are important and need to be thought about have long had some clues to get answers in people's daily practice. As the saying goes, habit becomes nature. Learning to become a person and getting used to it, the former emphasizes the criticality of "learning", and the latter provides a path to "becoming", and both accurately portray the first extreme value of cognitive domain practice: getting used to it. Among them, "habit" is the path to obtain patterned cognition, and "normal" is the highest level of patterned cognition. In layman's terms, through continuous learning, people have the opportunity to acquire self-directed, patterned cognition of daily things without having to think.

Traditional China has a long history of exploring "cognition". In the era of the Hundred Schools of Thought, although each school had its own political or social propositions, they all had one thing in common, that is, they believed that there was no one in the world who was born with knowledge. Confucius said that he was "not born with knowledge", so who else could claim to be "born with knowledge"? On this basis, it is further believed that human cognition and cognitive level, that is, people often say that views, vision and realm are all acquired, and this is true for all the Hundred Schools of Thought.

When it comes to learning, we naturally have to talk about smartness and stupidity, that is, the impact of biological factors such as IQ on cognition. Confucius acknowledged that people's IQs vary, and therefore divided people's learning abilities into three levels, in addition to the most intelligent and the least stupid, there is also an intermediate level. Interestingly, Confucius advocated that there should be no distinction between the intelligent and the stupid, and believed that anyone can learn regardless of their level. Confucius also believed that as long as there is a motivation to learn (such as "to do", "to want", "to seek"), and to study seriously (such as "learning and practicing it from time to time"), everyone can become a benevolent person and "learn and know it", it's just that some people know more and some people know less.

If biological factors affect the formation of cognition, social factors are related to cognitive influence. Mencius believed that mountains and forests are nurtured, and virtues are nurtured by society. "So if they are nurtured, everything will grow; if they are not nurtured, everything will wither." But how does society nurture? In society, people's behavior is a manifestation of social morality. Mencius said: "If you seek, you will get it; if you give up, you will lose it. Seeking is beneficial to getting, and seeking is within me. Seeking has a way, and getting is destiny. Seeking is not beneficial to getting, and seeking is outside." "Seeking" is both a learning impulse and a learning activity. "Seeking" naturally requires a method of "seeking". "A gentleman studies deeply with the way, and wants to get it by himself." For Mencius, learning is not only about getting the method, but also eliminating all kinds of interference, "doing one's best, knowing one's nature, and knowing heaven" to achieve the state of "reason and righteousness please my heart, just as grass and feed please my mouth."

Unlike Confucius and Mencius, Xunzi not only advocated learning, but also advocated continuous learning, "learning should never stop". Using analogy, Xunzi tried to prove that learning is like straightening wood with an ink line, and sharpening a knife with a whetstone. "Therefore, wood is straight when it is tied with a rope, and metal is sharp when it is sharpened. A gentleman is knowledgeable and examines himself every day, so he will know and act without mistakes." Moreover, Xunzi believed that "If you don't climb a high mountain, you don't know how high the sky is; if you don't stand by a deep stream, you don't know how thick the earth is; if you don't hear the words of the ancient kings, you don't know how great knowledge is." For Xunzi, learning is the only way to achieve habitual learning, "I have thought all day long, but it is not as good as what I learned in a moment. I have stood on tiptoe to look, but it is not as good as the broad view from a high place."

Evidence from the literature of various schools of thought shows that "learning" and "knowing" are the core categories of traditional Chinese discussions on cognitive domains. In the view of various schools of thought, people's learning abilities vary, but learning is still the only way to reach a certain level of cognition. Moreover, learning is not completed in one go, but requires continuous efforts and lifelong practice. Among them, introspection or reflection is an effective way to continuously improve cognitive levels and a way to form social consensus (Qiu Zeqi, 2022).

The question is, what is the purpose of constantly improving cognition? The discussion of various schools of thought shows that it is not to explore what cognition is, but to build a society of universal harmony. Based on this, we even think that the Chinese tradition's discussion of cognitive domain is more like a precursor to the current practice of cognitive domain. In the past, various schools of thought gathered related disputes under one theme around the social goal of universal harmony; now, in order to understand the cognitive domain, people have gathered many disciplines related to the cognitive domain under one theme. We have reason to believe that in the era of various schools of thought, the exploration of cognitive domain by each school was instrumental rather than truthful; and the goal of exploration was the same, even the inferior military strategists were among them (the military strategists will be discussed later), that is, no matter how people get used to it over time, the purpose is to internalize social goals into the daily practice of social members. Following this logic, we also believe that what is taken for granted shapes not only the cognition of social members, but also the concepts and culture of the entire society, as well as the inheritance and development of social concepts and culture.

If the Chinese tradition treats the cognitive domain as a black box, emphasizing the internalization of social rules into people's behavioral norms through the shaping of cognition over time, and providing a methodological path to achieve the goal of "learning to become an adult", which is instrumental; then, the Western tradition's exploration of the cognitive domain does not have the purposefulness of the Chinese tradition, but instead treats human cognition as an object, attempting to open the cognitive black box and explore the laws of cognition.

Aristotle's On the Soul uses hylomorphism to characterize cognitive activities such as human perception and thinking, and believes that sensory cognition and rational cognition are the result of the object imposing its own sensibility or rationality on the corresponding functions of people (Shields, 2020). Therefore, cognition is a process of abstracting rationality through sensibility and imagination. In Meditations on First Philosophy, René Descartes systematically refuted Aristotle's cognitive view of "subject-object correspondence". He believed that in human cognition, the truly reliable part does not come from sensory experience, but can only be the product of pure reason. John Locke questioned Descartes' rationalist view and pointed out in An Essay Concerning Human Understanding that the human mind used to be a blank slate without any pre-existing concepts and ideas; human cognition can only be the product of experience, and ideas always come from external perceptual experience and internal psychological experience. In his Treatise of Human Nature, David Hume used a skeptical stance to shake the authenticity and reliability of all knowledge derived from experience. In response to the doubts and challenges raised by Locke and Hume on whether humans have an internal cognitive structure, Immanuel Kant's Critique of Pure Reason, while acknowledging that "things in themselves are unknowable," proposed that humans can legislate for nature through sensory intuitive forms, intellectual categories, and concepts, re-proving the internal cognitive structure of humans and the truthfulness of scientific cognition.

A brief review can show that the Western tradition is more interested in exploring what cognition is and where it comes from rather than how to shape people's cognition and how to achieve a certain social goal by shaping cognition. Of course, the Western tradition also has efforts to use the cognitive domain as a tool. For example, Machiavelli focused on describing two types of people in his works such as The Prince and Mandala: one type of people is sober and calm, and has a clear understanding of the situation, conditions, interests, and human hearts. They are good at inducing and intervening in the cognition of others, and can eventually use the desires of others to achieve their own goals; the other type of people are purely driven by passion and desire, and are often deceived by the tricks of others, easily blinded by various illusions, and eventually become stepping stones for others to use. Even so, Machiavelli still revolves around cognition itself, rather than directing the exploration of cognition to a certain social goal.

Comparing the exploration of cognition in Eastern and Western traditions, we believe that taking things for granted is a traditional practice in the cognitive domain. In Chinese tradition, the real significance of exploring cognitive domains lies not in their content, but in the actual application of cognition by the cognitive subject. Chinese tradition ignores abstract concepts and logical reasoning, and pays more attention to people's judgment, contingency, and grasp of the whole and essence of things (Li Zehou, 1984). Indeed, as a purposeful cognitive domain practice, its ideal state is to use a variety of cognitive tools to construct people's patterned cognition in a silent and subtle way, shape common concepts, share common culture, and look forward to common social goals, such as the great harmony of the world. Although Western tradition focuses on the structure and process in the cognitive black box, it cannot deny the practical value of Chinese tradition. In fact, the cognitive domain practice of Western countries that began during the Cold War seems to be repeating the Chinese traditional understanding of cognitive domains, shaping people's cognition in taking things for granted.

The extreme value of being accustomed to things is that people's cognition of things is placed in the patterned cognition accumulated over time. However, patterned cognition is conditional, that is, people are in a stable environment and face familiar things. The problem is that people are not always in a stable environment and face familiar things. Once they are in a changing environment and face unfamiliar things, what should they do? This is another extreme value, the mind of non-patterned cognition changes with the environment.

Non-patterned cognition: the mind changes with the environment. The reason why humans have the opportunity to establish patterned cognition is that the characteristics/relationships of the cognitive objects are stable. Scientific research is a typical representative of human patterned cognition of natural phenomena, relying on the stability of the characteristics/relationships of natural phenomena. For example, the stability of the characteristics/relationships of celestial bodies at a given time, the stability of material properties in a given environment, the stability of material relationships under given experimental conditions, etc. Without the stability of characteristics/relationships, scientific research will lose the factual basis for establishing the relationship model between things, and patterned cognition will also lose its premise.

Similarly, the stereotyped cognition of social phenomena is also based on a certain stability of the characteristics/relationships of social phenomena. Remember the example of anthropologists studying other societies? The reason why anthropologists form their cognition of other societies by living in other societies for a long time is that the characteristics of other societies and their relationship with the outside world are relatively stable. Similarly, the reason why sociologists can form a stereotyped cognition of the relationship between education level and life achievements is also due to the relative stability of the labor market structure in industrial society; the reason why economists can form a stereotyped cognition of input-output relationships is also due to the relatively stable relationship between economic elements, and so on.

Unfortunately, on the one hand, the stability of things is not static. The celestial bodies are changing, the ecology is changing, the material relations are changing, and the society is changing. However, as long as the speed of change is not enough to affect the formation and adjustment of patterned cognition, patterned cognition is still an effective cognitive domain practice. On the other hand, maintaining stability also requires certain conditions, especially in the face of the organic world, such as maintaining the stability of the natural ecology; maintaining social stability is even more conditional. The purpose of the various schools of thought to emphasize social order is also to maintain social stability and try to shape the common cognition of society.

Once the speed of change affects the formation of people's patterned cognition, natural science will use experimental conditions to maintain the stability of material characteristics/relationships and provide opportunities for cognitive formation, such as given environmental conditions such as temperature, humidity, and air pressure to maintain the stability of the relationship between substances, such as controlling the ratio of different substances in the compound, the environmental conditions during the chemical combination, and the catalytic conditions. Social science involves human beings themselves and is constrained by human and social ethics. It is impossible to use experimental conditions to maintain the stability of social characteristics/relationships. For example, we cannot let some people receive a certain level of education and let others receive another level of education or no education to test the relationship between education level and life achievements.

Fortunately, in addition to social culture, the stability of livelihood technology also affects the stability of social characteristics/relationships. The stability of agricultural technology shapes the stability of rural social characteristics/relationships. The history of rural social development in China and abroad has proved that rural areas are settlement societies with relatively small populations, acquaintance societies, and mutual assistance societies. The social structure and social environment of rural society are relatively stable, enough for people to form a stereotyped cognition of rural society. The reason why Fei Xiaotong's "Rural China" can still resonate with readers today is that rural society is relatively stable. Getting used to it is an appropriate portrayal of the practice of the cognitive domain of rural society.

Compared with agricultural society, the characteristics/relationships of industrial society are less stable, especially in the late industrial society, where the large and rapid flow of population has changed the necessary conditions for forming patterned cognition. From familiar places to unfamiliar places, from relatively simple and easy villages to relatively complex and difficult cities, people are in an increasingly unstable environment, and the things they face are becoming increasingly unfamiliar. Anyone who is on the move will experience that the cognitive experience in the countryside cannot be applied to the city, and the cognition in place A is difficult to apply to place B, so that it becomes increasingly difficult for people to form patterned cognition.

How will people carry out cognitive practice in the face of unstable cognitive environment and unfamiliar cognitive objects? Adapting to changes in the environment and cognition in the face of unfamiliar objects is another extreme of cognitive domain practice, that is, the mind of non-patterned cognition changes with the environment. It should be specially explained that the "mind" here does not only refer to psychology, but also to the mind, mood, mentality, etc. "Change" emphasizes that cognition changes with the environment and the changes of cognitive objects and is no longer patterned, that is, it emphasizes the adaptability of cognition.

Looking back, adaptability is also a kind of cognitive norm. As mentioned before, in the past, the changes in the environment and things were not fast enough to affect the formation of patterned cognition. People are always in the changes of the environment and things, and they adapt to the changes by adjusting their patterned cognition. Changes in the norm, such as rise and fall, success and failure, are actually changes that people are familiar with and are part of patterned cognition.

However, when the speed of change of the environment and things exceeds the speed at which people establish and adjust their patterned cognition, abnormal changes will appear. Abnormal changes are changes that people are not familiar with, and they are a challenge to patterned cognition. Among the changes that people are not familiar with, rapid and continuous changes constitute the greatest challenge to cognition, and also give rise to another kind of adaptable cognition that changes with the environment: adaptability.

There are many classic examples of improvisation in human history, ranging from famous wars to personal situations, such as the Empty City Plan. When it comes to strategies, people naturally think of war. Indeed, the military strategy is a classic example of the mind changing with the situation. Compared with daily life, the characteristic of war is the rapid change of the battlefield pattern. In the face of rapid changes, on the one hand, military strategists still hope to use patterned cognition and emphasize the "knowledge" of the battlefield pattern. For example, the word "know" appears as many as 79 times in "The Art of War" by Sun Tzu, and Sun Tzu even established a system of "knowing victory" (Yao Zhenwen, 2016), as the saying goes, "Knowing the enemy and knowing yourself, you will never be in danger in a hundred battles." The classic nature of the military strategy also lies in the fact that the "knowledge" of one side means the understanding of "Tao, Heaven, Earth, General, and Law", which means the cognition of the conditions, situation, strategy, plan, and chance of victory of the war; conversely, the ignorance of the other side means that due to the intervention of the other side's trickery, it means falling into the dilemma of "not knowing what to defend" and "not knowing what to attack".

On the other hand, precisely because it is possible not to know, military strategists also emphasize adaptability, both to make one's own side "know" and to make the other side "not know". For example, "using a false route to attack the state of Guo" to attack the enemy when it is unprepared and unexpected, "lure them with benefits and take them when they are in chaos", "frustrate them with anger and make them arrogant", or "be able to fool the soldiers' eyes and ears and make them ignorant; change their tasks and plans to make them ignorant; change their residence and take a circuitous route to make them unable to think"; "attack them with actions, do not tell them with words; attack them with benefits, do not tell them with harm"; "like driving a flock of sheep, drive them away, drive them back, no one knows where they are going", the purpose is to shake their testable stereotyped cognition, and ultimately "the three armies can be deprived of their morale and the general can be deprived of their hearts". The strategy of military strategists is to use the rapid changes of knowing and not knowing to interfere with the formation of the opponent's cognition or make the opponent form wrong cognition, such as wrong emotions, attitudes, judgments, decisions, etc., so that the mind changes with the situation and becomes a battlefield fact, becoming a tool for combat in the cognitive domain.

Some famous scientific experiments have also proved that the mind of non-patterned cognition changes with the environment. The Stanford prison experiment is a typical example. In 1971, Philip Zimbardo, a psychologist at Stanford University, designed and implemented a role-playing experiment. He assigned student volunteers recruited from Stanford University to two groups of roles, one group was prison guards and the other group was prison prisoners, and placed the two groups in a simulated prison environment. Experimental observations showed that guards and prisoners quickly formed a cognition of their roles and put their cognition into action. One-third of the guards showed true sadistic tendencies, many prisoners were emotionally traumatized, and two had to withdraw from the experiment early. During the experiment, the cognition and behavior of guards and prisoners gradually exceeded the boundaries of the experiment, so that Zimbardo had to terminate the entire experiment early (Zimbardo, 1971).

In cognitive domain practice, the South African general election in the 1990s (Piombo and Nijzink, 2005), the financial crisis in 2008 (Lewis, 2011), the “Arab Spring” in 2011 (Anderson, 2011), and the US election in 2016 (Allcott and Gentzkow, 2017) further demonstrated cognitive domain practice of the mind following the environment. It is worth further exploring that, unlike the usual way of indoctrination, although these cases all showed the mind following the environment brought about by cognitive intervention, each link of cognitive domain practice, such as information acquisition, information processing, cognitive formation, and cognitive influence, was very different. The South African general election in the 1990s used mass media, the financial crisis in 2008 used false information dissemination, the “Arab Spring” in 2011 used interpersonal social networks, and the US election in 2016 implemented personalized and precise information delivery.

Therefore, the extreme value of the mind following the environment also presents a general trend, that is, the information feeding that prompts the mind to follow the environment is becoming more and more personalized and precise, giving the fed objects less and less time to process the information, and fewer and fewer opportunities to form patterned cognitive adjustments, so that the cognitive formation of the fed objects is becoming more and more like "accustomed to it", and the cognitive influence is increasingly shifting from the influence on the group to the influence on the individual to form an emergent social effect. When cognition is formed hastily and cannot be verified, the objectivity or correctness of cognition becomes a huge question mark, which is also the biggest challenge facing the cognitive domain at present and in the future.

**Current Challenges of Artificial Intelligence and Cognitive Domain Practice**

Inheriting the traditional practice of the cognitive domain, the development of digital technology has promoted the ubiquity of human connection, completely changed the environment and objects of human cognition, and then changed cognition from often facing a stable environment and familiar things to always facing a changing environment and unfamiliar things, making humans have to rely on the ever-evolving machine intelligence in the formation and influence of cognition. This dependence covers the entire cognitive domain, from information acquisition, information processing to cognitive formation, cognitive influence, etc. Digital technology has therefore changed from a tool to support human cognition to an unconscious subject that intervenes in human cognition. In turn, it forces conscious human subjects to face difficult social choices in the innovation and application of machine intelligence: let machine intelligence become a helper to support human cognition, or a tool to intervene in human cognition. But whether it is a helper or a tool, in the cognitive domain, the convergence of technologies to crack the human mind has already begun, and the general trend of human-machine interaction has begun to emerge and cannot be reversed. The challenges of cognitive domain practice seem to have reached the point where humans have to make a choice, and all of this stems from the innovation and application of cognitive science.

From cognitive science to machine intelligence. As briefly mentioned at the beginning, cognitive science is a problem-oriented scientific field that spans disciplines such as philosophy, psychology, computer science, neuroscience, linguistics and anthropology, aiming to reveal the mysteries of human mind and thinking. People hope to create machine intelligence with human cognitive mechanisms outside of human subjects through conjecture, empirical evidence, fitting and iteration of human cognition.

A coincidence in the history of science is that in the 1950s, Herbert A. Simon and his student Allen Newell in the field of computer science first proposed the concept of human thinking mechanism (Newell et al., 1958), transforming the human information processing process into a symbolic interaction process, and through calculation and verification (Newell & Simon, 1956; Newell et al., 1959), proved that human cognitive phenomena can be explained by several basic information processing mechanisms (Simon & Newell, 1971). Almost at the same time, cognitive psychologists proposed the Information Processing Theory, arguing that the human mind is an information processing system similar to a computer, and that psychological processes such as perception, memory, language, thinking, and decision-making can be understood as different cognitive processes such as information acquisition, information processing, and cognitive formation (Miller, 1956; Neisser, 1967).

The coincidence of computer science and cognitive psychology in understanding human cognition formed an early disciplinary collaboration and produced artificial intelligence of that era. For example, Newell and Simon successfully developed computer programs such as "Logic Theorist" (Newell & Simon, 1956) and "Universal Problem Solver" (Newell et al., 1959) that simulated human cognition, and used heuristic methods used by humans in problem-solving. Heuristic strategies are actually the characteristics of human cognition observed by cognitive psychology, such as being able to process information step by step in order, but not in parallel; being able to quickly form short-term memory, but the capacity and duration of memory are limited; only taking a long time to form more persistent and larger long-term memory, etc. The use of heuristic strategies made computers no longer just labor for performing numerical calculations, but could replace exhaustive methods with purposeful searches and limited calculations, presenting the earliest form of machine intelligence. In other words, a set of clear, explicit, and operational computer operating programs was used to fit the mechanism of humans solving boundless problems with limited cognitive abilities.

Based on the basic framework of machine intelligence, the discussion of human cognition is carried out along the three basic dimensions of human cognition, namely information acquisition, information processing, and cognitive formation. For example, information acquisition involves perception and learning; information processing involves memory, language, and thinking; cognitive formation involves judgment, opinion, choice, and decision-making. In the advancement of various disciplines, John R. Anderson and others proposed the human associative memory model (Anderson & Bower, 1973); Marvin Minsky proposed the cognitive process framework, which is a hierarchical information structure formed by past experience and describing typical situations (Minsky, 1974). The habitual patterned cognition is an example of the use of the framework. Roger Schank proposed the concept dependency theory of natural language understanding, which reduces the understanding of language to the operation procedures of basic semantic units and conceptual relationships (Schank, 1972). At the intersection of disciplines, computer scientists have designed and implemented information processing systems that have the beginnings of general intelligence and are capable of performing a range of major cognitive tasks (Laird et al., 1987; Anderson, 1983).

At the same time, based on computers, interdisciplinary scientists have attempted to go beyond the fragmented simulation of individual cognitive processes and are committed to establishing a unified cognitive theory (Newell, 1994), establishing a complete and unified cognitive architecture. For example, they have confirmed that human cognition is not a black box, but a set of scientific mechanisms that can be fitted by computers, the most important of which is the input-output (I/O) mechanism.

However, how to deepen the understanding of input, processing, and output and put them into practice in the cognitive domain? In this regard, there has been a fierce debate between symbolism and neurophysiology (Lighthill, 1973). As a result, neurophysiology has gradually become the main source of inspiration for fitting human cognition. In fact, as early as 1943, McCulloch (Warren S. McCulloch) and Pitts (Walter Pitts, 1943) pointed out that the essence of human cognition is the computational activity of neurons (McCulloch & Pitts, 1943). On this basis, Frank Rosenblatt proposed a more complete and operational perceptron neuron model (Rosenblatt, 1957), which depicts the underlying mechanism of cognition: neurons receive information from sensory input and perform operations. When the result of the operation reaches the threshold, it will activate the next level of neurons to receive information and perform new calculations; countless neurons are connected to form a neural network, and can adjust the weight of the operation process and the threshold conditions of execution according to feedback information to deepen cognition. The perceptron theory opened the way for explaining the human cognitive mechanism from a neurophysiological perspective, and the neural network became the focus of subsequent efforts. On this basis, the multi-layer neural network model simulates the hierarchical structure and functional differentiation structure formed by the interconnection of neurons, and has the ability of deep learning on multiple layers. The artificial neural networks that simulate human cognition established by computer scientists have already taken shape, and machine learning has successfully simulated more human cognition and surpassed humans in many aspects.

The success of neural network practice proves that human cognition is not processed in the form of complete symbols. Any change of mind with the environment is just a collection of "cognitive" emergent properties (Hopfield, 1982; McClelland et al., 2010) that emerges from the sub-symbolic layers similar to what we are used to. In other words, human cognition is not always structured. In this way, if the information used for processing comes from the environment, then the relationship between cognition and the environment means that "information acquisition" as an input part naturally enters the field of vision of the cognitive domain and becomes an important part of the exploration of the cognitive domain. Learning and debugging become another stage of understanding human cognition.

The accumulation of data and the development of computing power have promoted the development of artificial intelligence represented by neural network models and machine learning technology. In addition to humans, machines can already simulate human cognition such as perception, memory, calculation, language, problem solving, and decision-making, and they are far superior to humans in terms of information capacity, workload, execution level, and completion quality in each link. Philosophy of mind and psychological science have begun to re-examine cognitive science and its applications. Based on the fitting of cognitive details, four types of interrelated cognition (not just human cognition) have been proposed as a whole: embodied cognition, embedded cognition, extended cognition, and enactive cognition. It is believed that the cognitive subject is embedded in the environment, and through interaction with the environment, it dynamically generates cognition, and further extends cognition to the environment (Wilson, 2008; Rowlands, 2010).

At this point, the mechanism of cognition is understood as perceiving the environment, learning and adjusting, and optimizing predictions and actions according to the free energy principle (Friston, 2010; Clark, 2013, 2015), providing a more holistic practical path for machine intelligence. It is in this sense that we believe that the judgment of artificial intelligence capabilities (such as weak artificial intelligence and strong artificial intelligence) (Searle, 1980) is nothing more than an inference based on human cognitive capabilities. It not only cannot deny machine intelligence (Pollock, 1995), but also cannot allow humans to avoid the challenges that machine intelligence brings to the cognitive domain.

Towards the cognitive domain of human-machine interaction. In the cognitive domain, since the birth of the first electronic computer, machines have been constantly surpassing humans in some aspects of information acquisition, information processing, cognitive formation and cognitive influence. Initially, it was in the information processing link. On February 14, 1946, the emergence of ENIAC marked the surpassing of machine intelligence over human computing power. If we want to understand in which aspects machine intelligence surpasses human intelligence, we can establish a timeline for the subsequent development of machine intelligence, marking each node where machine intelligence surpasses human intelligence. However, before the emergence of generative artificial intelligence, no matter where human cognitive ability is used, machine intelligence has always been a tool for human cognition and a helper to help humans improve their cognition. However, when generative artificial intelligence has acquired the cognitive ability of humans at a certain age and has high-level capabilities in many fields that were once considered to be human advantages (such as programming), people have suddenly realized that machine intelligence may no longer be just a helper to improve human cognition, but is becoming a machine subject that challenges the formation of human cognition.

Of course, when we say that we suddenly realize something, we are referring to the social level. The reason is that in the field of cognitive science, there have long been two ideas: one is to replace human cognition with machine cognition; the other is to use human-computer interaction to assist or even enhance human cognition (Winograd, 2006; Pavlou, 2018). If we understand the practice of cognitive science results in the field of artificial intelligence as scientists just wanting to create machine cognition that can be comparable to human cognition in addition to human cognition, then we can think that the long-standing debate is still limited to the scientific community. However, the emergence of generative artificial intelligence suddenly pushed the ideas of cognitive science decades ago to the front of society. Supporters of the substitution theory believe that human cognition will eventually be replaced by machine cognition. Ray Kurzweil's "technological singularity" generally predicts that machine cognition will eventually surpass human cognition (Kurzweil, 2005). Other discussions provide judgments on the replacement of human cognition by machine cognition in specific areas (Brynjolfsson & McAfee, 2014), including the possible conflict between machine cognition and human cognition (de Garis, 2005).

Those who support the view that humans are cognitive subjects believe that machine cognition can only be an auxiliary to human cognition. Joseph CR Licklider proposed the concept of Man-Computer Symbiosis as early as 1960 (Licklider, 1960). He believes that the cognitive abilities of humans and machines are complementary. Computers can complete the formal part of thinking for humans and undertake programmed preparatory work (such as statistics, making charts, etc.). Humans focus on high-level cognition, such as forming problems, setting goals, proposing hypotheses, evaluating and analyzing, etc. Engelbart (Douglas Engelbart, 1963) proposed that the development prospect of artificial intelligence should be the augmentation of man's intellect, that is, the enhancement of human cognition. He defines augmented intelligence as the improvement of human ability to solve complex problems in a cognitive context that combines human judgment with intuition, standard procedures and operations of machines, which includes faster and better understanding of the current situation, faster and better solutions, etc. In his view, human beings have been striving to enhance their cognitive abilities for a long time. Historically, people have formed hierarchically structured enhanced intelligence systems through language, artifacts, training, etc. Computers are expected to form new cognitive structures through interaction with these factors and further enhance human intelligence.

Further exploration also believes that the emergence of wearable devices is an example of enhancing human cognition, such as enhancing people's perception of the environment and physical state; enhancing people's memory, especially strengthening the memory of individual, sensory experience; enhancing people's motivation, through goal planning, progress tracking curves, group member evaluation, personalized assessment, providing incentives, etc. to help people achieve set behavioral goals and change their own cognition and behavior patterns (fitness software is an example); enhance people's decision-making ability, provide instant information support, and make personalized suggestions for the timing and choices of decisions; even improve people's emotions, such as using real-time information monitoring of the human body to identify people's emotions, and provide timely psychological stimulation, etc. (Xia & Maes, 2013; Pirmagomedov & Koucheryavy, 2021).

We have observed that with the development of machine cognition, machines no longer just execute predetermined programs, but have learned to conduct innovative exploration through trial and error, including proposing questions, goals, hypotheses, and analyses that humans have never imagined. Whether in information acquisition, information processing, or in cognitive formation and cognitive influence, human cognition and machine cognition are not just coexisting symbiosis, nor are they machine cognition assisting human cognition, but rather they are mutually stimulating and evolving, thus forming an intergeneration between the two.

Unfortunately, people may only see the human enhancement brought by machine cognition, such as the close integration of smart wearable devices with personal life, which enables individuals and technology to evolve together, and achieves targeted and planned human enhancement through customized and personalized technical equipment (Xia & Maes, 2013). It is worth noting that if we only observe human enhancement, it may be because we have ignored the synchronous enhancement of machine cognition. In this blind spot, some people even believe that the ideal human-machine relationship should be: wearable devices and the Internet of Things are responsible for information acquisition, machine intelligence is responsible for information processing, and humans are responsible for emotion, intuition, judgment, and creative decision-making. The combination of the three will be better than pure artificial intelligence (Pavlou, 2018). In this regard, people even imagine: using wearable devices as "senses", the Internet of Things as the "nervous system", and computers as the "brain", the three are combined to form in vitro cognition to enhance human cognition (Song Chunyan, 2016).

If the cognitive domain is limited to cognitive science and artificial intelligence, perhaps our discussion can end here. However, it must be noted that digital technology not only affects artificial intelligence, but also affects many fields, such as life sciences; artificial intelligence is not only applied to cognitive science, but also to other fields closely related to cognitive science, such as nanotechnology. The "Converging Technologies for Improving Human Performance" conference held in the United States in 2001 proposed the Human Cognome Project, which has the same far-reaching significance as the Human Genome Project, aiming to thoroughly crack the structure and functional mechanism of the human mind. In order to complete this plan, the integration of nanotechnology, biotechnology, information technology, cognitive science, and technology convergence (NBIC) was proposed, and it is believed that only the convergence and integration of the four major disciplines will have the opportunity to thoroughly reveal the mystery of human cognition (Roco & Bainbridge, 2013). The technical logic of NBIC is: as long as cognitive scientists can think of it, nanoscientists can manufacture it, biological scientists can use it, and information scientists can monitor and control it. The conference believes that convergent technology is expected to improve human cognitive performance from a physiological structure perspective, increase the consciousness, efficiency, innovation and precision of thinking, fully develop the potential of the human mind, and further enhance human performance. Faced with the technological prospect of transforming and enhancing humans, Andy Clark believes that future humans will be "cyborgs" integrated with technology, tools, and machines; and confidently asserts that humans have had the ability to integrate external tools, culture, technology, environment and other non-biological factors into themselves since ancient times, and "cyborgs" are just the natural development result of an ancient process (Clark, 2001).

Today, the grand vision of convergent technology has been partially realized. Human enhancement technology has entered daily practice, such as drug intervention, device implantation, genetic engineering, etc.; cognitive enhancement technology has also begun to become a reality (Song Chunyan, 2016), such as nootropics, which can use chemical substances to intervene in neural circuits and molecular activities, affect people's cognitive performance, and enhance cognitive functions such as memory, attention, and creativity (Lanni et al., 2008); brain-computer interface technology can also control external devices by decoding cognitive neural signals (Andersen et al., 2022).

Unfortunately, people have to admit that there are still insurmountable obstacles in establishing a practicable logical link between external signals and formalized information, as well as between cognition and consciousness. This has also led to doubts about the feasibility of convergent technology goals, such as whether human cognition can be transformed and whether the "brain in a vat" (Putnam, 1992) can be realized. People realize that the true realization of human-like cognition depends on whether the advanced assumptions of artificial intelligence can be verified, such as the consciousness process is equal to the information processing process, which can be written as a formal algorithm; the consciousness state corresponds to the neural signal state one by one, and the biological algorithm of the consciousness process and the physical algorithm of the computer system can be perfectly transformed (Zhang Changsheng, 2021).

However, even if these assumptions are not true for the time being, and brain-computer consciousness interaction and cognitive control are temporarily difficult to achieve, existing facts have already proved that the theory and practice of cognitive domains such as information acquisition, information processing, cognitive formation and cognitive influence that integrate various technologies (not just convergent technologies) have partially realized human-computer interaction, which means that in the face of rapidly changing cognitive environments and always unfamiliar cognitive objects, humans have the technical support to quickly form cognition and make cognition have an impact.

However, since the information acquisition and processing capabilities of machine intelligence far exceed those of humans and humans are unable to verify, this means that the cognition of human-machine interaction is potentially subject to huge risks due to the uncontrollable information acquisition and processing. For example, by changing the content or structure of information, the neutrality and completeness of information acquisition are affected, and by intervening in information processing, the output of information processing results are affected, which ultimately affects the formation of cognition and cognitive impact. Amid the huge risks in the cognitive domain, safeguarding cognitive fairness and justice to safeguard humans has also become the biggest challenge facing cognitive domain practice.

**Short conclusion**

One flower, one world; one tree, one bodhi. This means that everyone has his or her own cognition. The cognitive domain can be understood as the scientific process of human cognition of the world, or as the subjective concepts and ideologies that influence human actions. In the past, human cognition was formed in daily education. Information was obtained from people's familiar environment, and information processing had an established pattern. Therefore, people formed a patterned cognition for familiar things, and were able to calmly face all kinds of things that came their way in the habit of taking things for granted; of course, people will also encounter the unfamiliar. As long as the unfamiliarity does not exceed the speed at which patterned cognition can be obtained, people will still choose to adjust the patterned cognition to face the unfamiliar. At least in China, traditional cognitive domain practice is always between taking things for granted and changing with the environment, forming social customs and accumulating social culture in a stable daily life.

Digital technology has made humans no longer live in a society of acquaintances, but always face a rapidly changing environment and unfamiliar objects. In the ubiquitous connection, humans are no longer able to rely solely on their own cognitive abilities to form cognition and establish patterned cognition, and have to turn to machine intelligence. Coincidentally, after decades of development, machine intelligence also has some human-like cognition, and in some aspects of the cognitive domain it even far exceeds human capabilities, and has formed a huge risk gap between human cognition and machine cognition. Filling or utilizing this gap is the difficult choice facing the current scientific field and human beings themselves, and it has therefore become a new stage for the game between major powers. To this end, we should call on China's traditional reality observation and promote human care in the development of cognitive domain theory and practice.

(This article is part of the results of the sub-project "Research on the National Governance of Digital Society" of the National Social Science Fund Major Project "Research on the Characteristics of Digital Society under the Background of New Technology Application", Project No.: 19ZDA143; Song Yuanhang, a doctoral student in the Department of Sociology of Peking University, also made important contributions to this article)

**Notes**

[1] Psychology is not the same as cognition, but it is a prerequisite for the formation of cognition. For example, the word “conquer” in “conquer the enemy without fighting” is a kind of cognition, not just psychology. However, before forming the cognition of “conquer”, people will have many psychological activities that affect the formation of “conquer”.

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