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A Pluralistic Mind Approach to the Complementarity Between Schema and Language

XIE Jian-hua
Taiyuan Normal University, Jinzhong, China

The traditional view is that understanding knowledge is based on language. Is language a sufficient condition for cognitive knowledge? Pluralistic mind holds that understanding knowledge can be obtained independently through schemata. Schema-based cognition is not the only component of cognitive structure. The important language and quasi language thinking play a great role in cognition. Expounding the relationship between schema-based cognition and language and quasi language like thinking can explain the cognitive complementarity between schema and language. It shows that with the increase of language and quasi language thinking, the form of thinking is continuously enhanced and transformed through schema-based cognition. Language and quasi language thinking are cognitive abilities different from schema cognition. They are relatively new additions to cognitive tools. Language and quasi language like thinking are of little use to animals which do not have enough schema forming ability.

Keywords: pluralistic mind, schema, language, complementarity

Introduction

Is language a sufficient condition for cognitive knowledge? The pluralistic mind believes that the cognitive ability of the mind is not limited to the linguistic cognition of humanism, it also includes pre-anthropological animal cognition, post-anthropological machine cognition, and cyber cognition (Xie, 2020, p. 28; Xie, 2021, pp. 119-133). The pluralistic mind uses the "psychological schema" as the understanding unit of the core knowledge system, folk theory, and scientific theory. As such, schema is an idealized unit of domain scale understanding (Nieh, Schottdorf, Freeman, Low, & Tank, 2021, pp. 80-84). The schema is an idealized domain scale understanding unit. Each schema has its own internal ontology to represent the objects, attributes, relationships, events, and processes of its content domain, as well as its own reasoning rules about the properties and transformations of these.

The traditional view is that knowledge is based on language. The pluralist mind holds that knowledge can be obtained independently through schemata. However, schema-based cognition is not the only part of human cognitive structure. At the same time, schema-based cognition is not unique to human beings. There may be some relatively simple animals with innate (species typical developmental channelization) cognitive mechanisms. These innate cognitive mechanisms encode the systematic characteristics of the field in a way that allows them to be used as schemata. Acquired ability to acquire schemata through learning (having a schematization ability) has also been widely proved in many taxonomic populations. Schemata and schematization capabilities are

XIE Jian-hua, Ph.D., Lecturer, School of Marxism, Taiyuan Normal University, Jinzhong, Shanxi Province, China.

associated with other components of cognition and intelligence. To explore this problem, we need to expand from philosophy and psychology to cognitive behavior and evolutionary psychology.

There are different factors in the cognitive structure of human and non-human animals. Some of these factors may have been first evolved by other animals. Language plays a more important role in human cognition. These factors often play complementary roles in cognition. This combination accomplishes more tasks than the sum provided by other animals. Different cognitive systems can complement each other. This complementary basic orientation can be used as the basis for the relationship between schema-based understanding and the most prominent feature of human mind—language thinking. In the process of human cognition, schema and language are complementary.

The Promotion Construction of Language to Schema

The cognitive benefits of thinking with common language and similar language are more than those obtained only through schema-based cognition. Common language and quasi language like thinking can enrich schema-based cognition. Language thinking increases the content of using the schema alone. Language thinking and schema cognition can interact and organically combine to produce greater synthesis.

Cognitive Extension of Language to Schema

The most obvious advantage of common language is that it can communicate in a way that does not exist in the schema. Humans can build usable external schemata for certain things they think about. These schemata are essential for guidance, communication, and common concern. However, building only external schemata is a troublesome form of communication. On the one hand, human speakers and listeners have similar ways to communicate in the field of understanding. On the other hand, humans use language in the process of teaching each other to use new schemata.

In daily language communication, the speaker and the listener exchange information in the understood schema. If a person says, “there will be a blizzard tomorrow”, and you know the local weather pattern at this time of year, then this conveys some specific meaning. In winter in the Northeast of China, someone heard that there would be a blizzard, and may prepare snow removal tools. In the summer of Hainan Island of China, some people may think this is nonsense if they say the same. These understandings arise from different kinds of meteorological schemata.

Only when the speaker and the listener share the referential framework provided by the psychological schema can the communicative use of language be completed. When schemata are shared, short utterances can provide rich information for complex reasoning. Without a common understanding, it is impossible to understand vocabulary, meaning, and reference. Reading a sentence but knowing nothing about a topic at random may recognize it as a grammatical sentence without really understanding what it is saying. The schema located in the background produces a possible perceptual expression space in the language. Understanding the semantics of ignorance requires a large number of relevant schemata.

There is no need to start from schema learning and start from scratch. Language can provide a more effective way to complete the acquisition process of the schema. Using language in this way is exactly what is needed for a good explanation or understanding. In some cases, a good explanation may be external cues. The speaker or listener needs to form a schema corresponding to the speaker or listener. In other cases, language can play an important auxiliary role, such as pointing out the location of important variables and correcting or improving

learners' comprehension. Learning a manual skill, a dance form, or a new music structure is inseparable from the contact and practice in the field of learning. Even so, verbal cues can be used. By communicating in terms of other languages, you can quickly modify the new schema you are building. Terms based on the new schema can be combined with examples to help learners pay attention to the units determined by the new schema.

Lakoff and Johnson (2003) believe that many human understandings are based on metaphor. Metaphor can be associated with schema-based understanding. Metaphor transformation is to use the schema structure of one domain as the schema structure of another domain, and modify the latter to adapt to the differences between domains. In the standard sense, metaphor is a linguistic phenomenon. Lakoff and Johnson (2003) believe that human language is formed by metaphor. Lakoff and Johnson's views are not comprehensive. Nonverbal mechanisms can also transform the structural features of the schema into a new field. Nonverbal methods can also achieve this result. Only the metaphorical mechanism of language is more effective and broader. The metaphorical mechanism of language is a powerful tool to convey the form of schema-based understanding. Lakoff and Johnson's example uses conflict metaphor to enable the listener to activate the conflict schema as a way of reflection. The listener may eventually think of this way of looking at things independently. However, language enables it to be quickly transmitted and spread through the community, thus expanding the repository of schemata of daily communication.

Some concepts of psychological schemata are forms of understanding that non-verbal subjects cannot obtain. Some schemata in the field of language—poetry schema and speech schema are not available to non-verbal subjects. Scientific understanding requires more than mastering grammar and reference. Without strict linguistic representation and forms of communication, human beings are unlikely to surpass folk physics or folk biology. It can be imagined whether a mature and normal form of folk theory can be developed in the absence of normal language communication. After all, language communication is a part of the normal development of human childhood. Similarly, the acquisition of the form of mathematical understanding goes beyond the innate form of human existence. This is achieved through language communication. This can take advantage of the abilities originally used for language or quasi language cognition.

It is unclear how much of the psychological schemata used by humans depend on language. This ratio may be quite large. Language provides new forms of representation, communication, and interaction. This is especially true in terms of the ability to form specific problems. These expand the formation mode of human exploration and discovery and the related fields of interactive thinking. The field of human psychology needs to be mastered. Some fields are only presented to human beings through language thinking and communication.

Inherent Creation of Language to Schema

Language has brought a basic progress. Language provides a medium that enables humans to think about ideas that combine different schemata. Reasoning patterns used in lexical items in language or similar language thinking come from their schema operation. However, from the perspective of language and quasi language thinking, the origin schema of lexical items or conceptual items is irrelevant. It is just a unit of a specific logical or grammatical type. Concepts and morphemes derived from different schemata can be combined grammatically. Concepts and morphemes can be connected with logical connectives. The resulting propositions can be combined into the form of logical reasoning. The validity of propositions does not depend on their semantic value. This endows human beings with the ability of cross domain representation and reasoning. This is not simply using two schemata in series.

This is a huge cognitive progress. Language is one of the most important features of real human cognition. However, the combination between schema-based understanding and quasi language like representation is not perfect. There are some sentences with good grammatical structure but no meaning. A single lexical item may represent elements in multiple schemata. In these schemata, the functions of a single lexical item are different. This will produce ambiguity and backward logical reasoning. In logical reasoning, people tend to assume that the concepts used have clearly defined extensions. People often forget that the concept of psychological entity often has fuzzy boundaries and originates from idealized schemata. It is expected that language and logical reasoning of language have divalence and well-defined extension. However, this does not match what schema-based understanding provides. This is a psychological explanation of the paradox. Language and schema cannot complement each other perfectly. This is because the thinking form similar to language is optimized for purpose, and the understanding form based on schema is also optimized for purpose. Language provides some special contents in schema resources.

First, language provides the basis for creative cognition. The formation of grammatical sentences is not limited by schema-based semantics. New sentences can be constructed at will to some extent. On the basis of schema-based thinking, human beings can construct sentences of things they may never think of. Most randomly constructed sentences have little cognitive value. Some are interesting (such as puns) and some are infectious (such as poetry). They may inspire new ways of thinking. This provides a really useful new way to understand the world. The initial creative behavior may not be the product of reflection, but may produce new reflection.

Second, language provides the basis for higher-order cognition. In higher-order cognition, humans think about ideas or thought structures. Some basic forms of higher-order cognition are nonverbal, such as only perceiving that the self has a special feeling or experience, also known as “higher-order perception” (Armstrong, 1968, p. 74.). However, the analytical ability of higher-order cognition lies in the ability to pay attention to the characteristics of thought. Higher order cognition pays special attention to the thoughts expressed in language and the ability of language representation of these thoughts. Human beings can represent a concept as a thinking object, not just think about other things through it. At this time, human beings will think about the clarity of concepts or the meaning of propositions. Only by characterizing concepts and their constituent propositions as special objects can we test the effectiveness of argument and the persuasiveness of reasoning. This is the ability to regard thought and its linguistic or logical representation as the object of thinking.

Third, language provides the basis for critical cognition. Critical thinking may depend essentially on public language. On the one hand, critical thinking usually includes thinking about the representation expressed in public language. This can be done without public speaking. On the other hand, individuals learn critical thinking through dialectical interaction with others. It cannot be ruled out that a smart person may develop critical thinking by himself. However, generally speaking, the ability of personal critical thinking is produced through the internalization of interpersonal dialectics. Even a smart person who independently creates critical thinking will use the ideas expressed in language to carry out critical thinking.

Fourth, language provides the basis for literal cognition. Writing is an important extension of natural language. A large part of the earliest extant texts are counting records. Anything that can be said can be represented by external symbols. Donald (1991, p. 47) believes that external symbol storage itself is an important watershed in the history of human cognition. External symbol storage enables the storage and retrieval of information to be determined from the instability of personal memory. Before the invention of

writing, the information available to a community was basically limited to what their predecessors knew. Text can preserve information indefinitely and spread it to a wide audience. External symbol storage is also an important cognitive prosthesis. Words expand and improve human cognitive ability so that they can think and reason more clearly. Written sentences can be examined and critically analyzed. Perhaps in the text, write down ideas that are difficult to express or understand orally. Text extends the storage limitations of auditory analysis. A written program helps to clarify the logical form of a proposition.

Fifth, language provides the basis for social cognition. Although knowledge and understanding can be attributed to individuals in a strict sense, their emergence is inevitably social. Like contemporary scientific theory and legal system, it is difficult to work alone. Personal work is based on others. The formation of a schema also requires a team composed of individuals with different professional knowledge and responsibilities to jointly create. The end product is what individuals can understand. However, in the process of forming the schema, no member of the team may have a comprehensive and detailed understanding of the whole product. The process of coordinating different components basically depends on language. Psychological schema is essential in this process. However, the coordination of the schema is not through the operation mechanism in the individual mind, but through carefully developed means of communication. This is based on language.

The Leading Role of Schema to Language

Schemata and languages think and reason in different ways. They are not separate ways of thinking. Schema-based understanding provides the basis for the semantic attributes of language. Language is popular and explicit. Explicit language provides a way to exchange ideas. Explicit language also provides a medium for humans to think about different ideas. Explicit language allows humans to acquire schemata that nonverbal organisms cannot. Language provides a platform for new types of reasoning. This includes not only construction based reasoning, but also various types of reflective thinking. These reflective thoughts require human beings to regard thinking and its linguistic representation itself as objects. Before the emergence of language users, animal schematization ability may have existed for tens of millions of years. The emergence of language has greatly increased the scope and ability of schema-based understanding. Some forms of thinking based on language have a history of only hundreds or thousands of years.

On the one hand, human cognition has its unique characteristics. On the other hand, humans share cognitive and intellectual components with many other species. The evolved ability of special purpose and learning through conditioned reflex provide a universal baseline for most animal cognition. These two abilities can be found even in animals as simple as flatworms. Further, there are other strategies. These strategies exist in different forms in many species. Some creatures turn the environment into an extended phenotype: bees build nests, spiders weave webs, and beavers build dams. Some organisms are socially distributed in cognitive function: the different traits and behaviors of different forms of termites may involve the differential expression of a common genotype; Among social animals, lemurs or prairie gophers take turns as sentinels. Some creatures have huge redundant perceptual systems: many creatures have multiple systems to extract depth cues. These systems can not only increase flexibility, but also obtain information related to the same purpose in different ways under different conditions. There have been other advances in the recent evolutionary lineage of mankind, such as the enhancement of mammalian curiosity and exploratory game ability, and the use of tools. These abilities have taken initial forms in many animals and have been greatly expanded in humans.

Many empirical and speculative problems are discussed in cognitive behavior, evolutionary psychology, and related fields: Which species have what special abilities? When might these special abilities appear in the history of evolution? What are the adaptive advantages of each species? What is the genetic relationship between species and their abilities? More general topics are emphasized here. This is about the different components of thinking. These different components may initially appear as different watersheds in the history of cognition. No matter how they first appeared, these abilities often exist in a complementary relationship rather than coexist with each other.

There are two distinct complementarities. The first complementarity means that each type of system has its own unique competence. Innate good strategies provide organisms with ways of doing things that they cannot learn through whiteboard conditioning. The cost of learning these strategies is very high. Animals are more or less required to respond to highly specific types of cues. These animals have the ability to identify the developmental channelization of potential mates. They need to perform the typical mating behaviors of their species without having to learn these abilities and behaviors through observation and trial and error. At birth or hatching, most animals are closer to the complete ability of adults than human young children. These species need to have this ability immediately. They cannot benefit from the long-term care of their parents. In contrast, being able to learn through conditional action precisely provides the content of the lack of accuracy of innate ability, enhancing the ability of an organism to adapt beyond its chosen range. This requires a response to the requirements of its current environment. The environment of the organism involved has sometimes changed significantly than that of its ancestors.

There is the second complementarity between the typical capabilities and conditional actions of channelized species. There are some closed instincts, such as the routine operation of wasps to put eggs into paralyzed locusts. But there are also many open instincts. The instinct of openness can be fine tuned through conditional action. Some species of wasps can nest better after many attempts. Kittens have the instinct to move small things, but only through practice can they become an efficient hunter. In a sense, internal ability and conditional function are unique components of the separation of cognition. The adaptability of animals is largely the result of their interaction.

Redundant systems provide parallel paths to extract information. Redundant systems obtain roughly the same kind of information, such as various ways for human visual system to obtain depth information. Redundant systems are also complementary. If an animal loses a system, it also has redundant systems to replace. Such cognitive ability is more flexible. Humans who lose one eye can no longer use binocular depth signals. However, he still has many monocular signals to use. Different systems also use different types of information. Different systems benefit differently in different environments. Monocular adjustment adjusts the focus of the eye lens. The eyes converge to observe the object at close range. Monocular motion parallax is used to observe objects at medium distance by moving the head. Linear perspective (such as the two sides of the road converging in the distance) and aerial perspective (the blue hazy appearance of the distant mountains) are for long-distance observation of objects. In a visual event, the correct estimation of distance may require the use of multiple cues. The difference between the information provided by the two systems will promote the subject to search for more information.

Historical Priority of the Schema to Language

Some non-human species also have some schematization capabilities. These species coordinate with different supplies in the world through different sensory organs and body forms. These species can form

schemata of things that humans cannot form. However, the number and variety of things that humans can form schemata far exceed that of other species. This is partly due to some differences in the neural mechanisms that ultimately support the formation of the schema, or because there are more such resources in the human cerebral cortex. This phenomenon is also related to other human capabilities that complement the formation of schemata. The ability to use tools is often considered to be the main factor leading to the significant improvement of human intelligence. The ability to use tools includes the ability to learn the use of tools at any time, invent new tools, and teach tools through social guidance (Ford, Ellis, Matkin, Balcomb, Briggs, & Morton, 2005, pp. 603-618). This ability seems to go hand in hand with the ability to learn new schemata. To some extent, this is obvious. One needs to learn a schema that uses specific tools to use it effectively.

In addition, there are links to broader schema systems. On the one hand, humans do not hammer or cut just for hammers and saws. These activities are meaningful only in the context of a further collection of these activities. Hammering and sawing make sense in a broader context through carpentry and these materials that require molding and specific types of connections. The expansion of the scope of utility and the schemata related to these utilities create a market for the ability to invent and use tools. On the other hand, tools expand human understanding and utilization of the supply mode provided by the world. Without the necessary tools, many of these supplies are not only unavailable, but also invisible to humans. Tools have changed the scope and type of schemata that humans can have. This is particularly evident in scientific research. Microscopes, telescopes, prisms, and centrifuges allow humans to explore new phenomena and analyze them in new ways. The experimental setup reveals a new systematic relationship between variables. At the same time, there is no clear dividing line between science and daily life. Simple machines such as levers and pulleys provide the basis for modern mechanics. At the same time, they originated from ordinary daily life. This can even be traced back to the rough tools used by early primate ancestors. These tools are rediscovered in underdeveloped forms in other primates today. Wooden tools have opened up a new world in which things can be made of wood. People do not think that interacting with branches with only eyes and bare hands will produce such a new world.

Active curiosity and exploratory play are characteristics of mammals. These can also be found in some birds. Curiosity and game are also highly complementary to the ability to form and improve schemata. It can stimulate the curiosity of the system to explore new objects and environments, and can be well combined with the ability to form a new content domain schema. There may be a close historical relationship between them. Positive curiosity is an advantage of exploratory games. Curiosity and games may co-evolve or appear independently. This depends on the comparison of their individual values and common values. Exploratory games can also be well combined with the formation of schemata. Exploratory games make the schema interact with the physical and social environment, and produce and improve it in a way free from selection pressure.

Identifying the complementarity between the cognitive systems of today's species and their characteristics will help to explain their evolutionary history and understand their interactions in the process of development. The two systems may appear independently, and their complementarity may be a happy coincidence. It is also possible that one system is a necessary precursor to another. Or, they initially appeared in different limited forms. The interaction between them provides conditions for the expansion and shaping of each other, so as to make use of their common interests. Although these various cognitive complementarities are intriguing, what we mainly discuss here is the relationship between schemata, language, and quasi language like ideas.

For the relationship between schema-based cognition and natural language, the emergence of schema-based cognition and its schematization ability seems to be earlier than that of natural language. The status of structured quasi language like thinking and its relationship with public language and psychological schema is a more complex problem. There may be some species (including primitive human ancestors) that have some degree of quasi language like thinking ability, but do not have the common language ability of grammatical expression. Quasi language like thinking may first appear as an internalized language form. This phenomenon can only be found among language users. The neural structure used for common language may also be the structure used for quasi language like thinking. However, the public and private expressions of these potentials are in principle independent of each other. A further difference is that the degree of development of each potential depends on whether they interact with others.

It is extremely difficult to distinguish between linguistic thinking and quasi linguistic thinking, private language, and public language and the relationship between them. It is very difficult to analyze the thinking mode of pre-verbal children or non-verbal adults. There is no way to test the language or quasi language like thinking ability of our long dead ancestors. At present, the problem of the origin and priority of baseline cognitive ability cannot be solved. However, it is reasonable to believe that some language based skills that can be practiced without public speaking are likely to be acquired and mastered through the use of public language. These skills usually also include the use of language instructions and written symbols. The basic ability of common language provides a framework. On this basis, further language skills can be established. All this also depends largely on the complementary relationship between schema and language.

Substantial Foundation of the Schema to Language

An obvious feature of language and quasi language thinking is their form. Language is a medium, which is characterized by syntactic structure and a large number of lexical elements occupying the space of language construction. Schemata also have their own specific forms. However, the schema is not characterized by sentence structure and reasoning rules. In a schema, the conceptual elements of the schema are closely connected with the reasoning rules and the way of world interaction. In language, human beings combine words. Human beings do not consider the source of words or the mode of semantic reasoning. In this sense, language and quasi language like thinking are universal in the field. The same language structure and rules apply to the representation of various content fields. The same construction can be used to combine elements in different fields. Proponents of central cognition and thinking language believe that human cognition involves not only the ability to think in a specific way in a specific field (Fodor, 1983, p. 105). It is recognized that domain specific understanding can take the form of learning schemata. This is not limited to developing modularity, but also in perceptual pre-processing.

The word “language” covers a wide range of fields. It is not only language structure and semantics, but also pragmatics, phonetics, phonology, prosody, dialectology and so on. Many components of natural language are not part of language thinking. The content items here include the acoustic and pragmatic features of public language. The “language thinking” here can be defined as such a thinking form: the structural unit of language thinking is similar to that of language. Language thinking must involve language construction, at least something structurally similar to language construction. The use of the word “language” is limited to the “formal language” spoken by humans. There are some narrow language concepts. These narrow language concepts simply regard language thinking as syntactic structure system, lexical types, and markers, as well as generation and reasoning rules on this basis.

Philosophers generally believe that quasi language like thinking must also contain some semantic elements that are the same as natural language (Block, 1986, pp. 615-678). In a sense, this is clearly correct. Generally speaking, when human beings think in a form similar to language, they are not dealing with a pure formal language. But how much of what people call semantics, even public language, is real language? The problem is not clear. This is because people have not specified what the boundary of language is. In the current context, the addition of language or quasi language like thinking adds cognitive resources to the existing schema-based cognition. People can get more accurate boundaries of language. If inferential semantics is based on nonverbal schemata, then a large part of semantics is not language.

Suppose someone said in words, “Napoleon is short and vain”. Understanding this sentence can make various inferences: Napoleon is short, he is vain, he is less than seven feet tall, he may respond poorly to criticism, at least one person is short and vain, and so on. How much of this understanding is the result of language ability or language thinking ability? Of course, just the ability to analyze and understand sentences requires language ability, in addition, the reasoning of sentences from “X is P and Q” to “X is P” or “something is P and Q”. This is probably based on understanding how language works. Similarly, for any construction based reasoning, it may be used as a premise. This is not based on real language ability, but on the schema of relevant content field, For example: what height is short when dealing with people, what is vanity, or how vanity people respond to criticism. One may have good language skills, but lack the knowledge of specific content areas required for semantic based reasoning.

In the thinking system of common language or quasi language, lexical items make use of the different forms of understanding provided by the schema to some extent. Language and quasi language like thinking can express what they understand through schemata. If someone is learning a language, she must learn the combination of vocabulary items and schemata. For example, a person who studies Chinese as a second language may already have a psychological schema of “vanity”. This person does not know that it is expressed by the word “vanity” in Chinese. However, if one is a skilled Chinese speaker, somehow she never formed a vain understanding. Then this problem cannot be corrected by further language learning. Instead, she needs to be familiar with the phenomenon of vanity and form a psychological schema to track the salient features of vanity. Perhaps there is a person with impaired social cognition who cannot understand vanity. She can see what people do to those labeled “vanity” and imitate them. However, this does not mean that this person understands vanity. When talking about that topic, she will pretend. This person’s deficiency in social cognition does not mean any damage to her language ability.

In order to explore the relationship between schema-based cognition, language, and quasi language like thinking, this paper explains “language” in a narrow sense. This does not include forms of thinking and reasoning based on schema-based cognition. In other contexts, it makes sense to adopt a broader interpretation. More broadly, “language” includes all the content that can be expressed in language, what can be done in language, and so on. The purpose here is not to assert the scope of the common use of the word “language”. The purpose here is to illustrate the contribution of language and quasi language like thinking ability of cognition and reasoning, rather than the contribution of schema-based cognitive ability. In this sense, language and quasi language thinking are a kind of representational intermediary. The feature of language is that syntactic structure and lexical elements are classified according to the syntactic position they can occupy.

Once language and quasi language like ideas are described in this way, two surprising meanings appear. The first meaning is that most or even all of the contents of semantics considered by human beings do not come

from language at all. Many or even all of the real semantic connections come from schemata. Lexical units can express and encode such semantic attributes. If there is no schema, the language will lack semantic content to a great extent. This leads to the second meaning: without this relationship with the psychological schema, language and quasi language like thinking will be useless and have no adaptive advantage. They will be similar to pure formal language. In this language, symbols can be rearranged grammatically, but there is no further connection between them or with the world. If it is based on the schema, then the ability can be produced only when it is really based on the schema. Language can greatly promote schema-based cognition. Without schema-based cognition, there is little adaptive advantage.

Two Supplements of Relevant Theories

The relationship between language, quasi linguistic thinking, and schema may face two objections. The first objection comes from mathematicians. Computational scientists may recognize natural language as a new and unique human feature. At the same time, calculators also argue that even if thinking is very different from the public language in some aspects, thinking must occur in a certain thinking language. The second objection is implicit in the discussion of causal semantics. Both public language and private language are bred by semantics. What humans need is not a psychological schema system. What human beings need is only a kind of language to represent the fixed referential relationship of lexical units in the medium.

Multi-layer Supplement of Computing Theory

Having only one internal language does not provide semantic understanding. In a narrow sense, internal language refers to a system with syntactic structure and a syntactic based program derived from other symbol strings. Supporters of psychological computing theory may argue that Turing shows how to track semantic relationships through syntactic operations. According to psychological computing theory, this is the first (perhaps the only) suggestion on how to achieve this goal. This does not require magical semantic interpretation of the meaning of the psychological process (Newell & Simon, 1956, pp. 61-79). The early exploration of schema-based semantic understanding diagram was realized in digital computer. These early explorations, such as Minsky's (1985, p. 47) framework, occurred almost simultaneously with other AI projects. These early explorations of semantic capabilities or simulations of semantic capabilities are based on syntax driven computing.

However, the "grammar" involved in this system is not the grammar of natural language. This involves that the input and output statements are not expressed in natural language. This "syntax" process is a machine language operation on binary numbers. These binary numbers themselves are not representational. Therefore, the calculation process in two senses must be distinguished here. In both senses, the computing process can be called "language" or "quasi language". At the same time, computers have been programmed to support some form of representation, such as natural language. The computer operates on these types of representations, such as some kind of intentionality. The types of these representations (some kind of intentionality) are structurally similar to sentence types or judgment forms. The "machine language" of a specific computer is the rule of the operating system and a kind of "grammar". However, this does not mean that symbolic units are structurally similar to sentences or judgment types. The grammatical form of machine language has little in common with that of natural language. The real meaning of calling machine languages "grammar" is that they are non semantic.

Therefore, when discussing that the computer is essentially a device that manipulates symbols according to grammatical rules, the real meaning is that the program has its own unique symbols and grammatical forms. This ultimately drives the performance of the computer. This is close to the definition of digital computing. In this process, there is no need to use any existence similar to natural language. Programming languages, especially those running at the most basic bit operation level, have little similarities with natural languages.

Proponents of psychological computing theory often confuse these two distinct ideas about the mind. One view of computational scientists is that intentional states such as beliefs and desires involve psychological representations. These intentional states are at least very similar to the structure in natural language. These intentionality states are the functional relationship with the representation of combinatorial grammar with subject predicate structure. Another view of computational scientists is that, generally speaking, thinking is represented by some form of symbols and driven by "grammatical" (non-semantic) processes.

Perhaps on some more basic levels, thinking is similar to the machine code of a digital computer with only the difference between chip and neuron implementation system. The second view applies not only to the intentional state of human experience, such as judgment. If human cognition is computational in this sense, the cognitive process of crocodiles and butterflies may also be computational. It is just that crocodiles and butterflies are simpler to calculate. Moreover, they are expressed in different machine languages of different types of brains. However, that thinking is computational does not mean it is structurally similar to language. If some quasi languages like structures are based on machine level architecture, it is not necessary to assume that the semantic properties of the system will appear in a specific quasi language like form. Instead, thinking may be the result of more complex structures (such as schemata) built on machine level architecture.

Therefore, even if we recognize three points of computationalism: first, the cognitive process is completed by calculation (in the sense of machine level); second, a quasi language like system is constructed from machine level computing resources; third, some types of data structures and machine level computing processes can give (or imitate) semantic understanding, it also needs to be clear that the types of data structures and machine level processes that produce understanding are not structurally similar to language. The difficulty in generating the development of structures such as semantic networks and frameworks shows that any representation of understanding programmed into a computer needs a structure similar to a schema, not a structure similar to a language.

Generalized Supplement of Causal Semantics

The research of Putnam (1975, pp. 131-193) and Kripke (1980, p. 47) led to a large number of philosophical studies in the field of semantics focusing on how to determine the reference of names and category words. With regard to the general concept that reference is determined through causality, there are several different propositions: Kripke's baptismal proposition, Fodor's (1987, p. 37) causal covariance proposition, and Fred Dretske's (1988, p. 27) purposive function proposition. These are related to causal semantics. In terms of purpose, the meaning of a word (i.e. reference) is its indicative function. This view provides a psychological representation system similar to language. Among them, the meaning of words contains semantic content, which does not depend on nonverbal units, such as psychological schemata. Such theories assume that a causal or purposeful functional relationship is sufficient to fix the reference of names (or psychological representations of similar names) and category terms (or concepts that determine categories).

This limits the semantic competence to the scope of reference and provides the reference interpretation of semantic competence, that is, to determine the individual and type.

This is a narrower and more limited semantic concept. Psychological schemata are not included here. Semantic understanding includes not only naming or determining the category of things, but also mastering the characteristics, relationships, behaviors, and transformations of things. Suppose that in the process of creating a term or concept for "water", human beings identify a specific type of substance and pick it out of all possible worlds. This does not mean that human beings have gained a further understanding of this substance. First, it does not imply that human beings have mastered the real attributes of such things. Second, it does not imply that human beings have any special "folk" understanding of the nature or behavior of such things. No matter what form of human understanding, human beings should use a set of systematic methods to characterize and infer. This process requires a psychological schema. Causal semantics holds that a causal relationship can ensure reference. However, this causality cannot confirm the schema. According to such a theory, it must be independent of reference to some extent. My twin earth replicator and I are isomorphic schemata that differ only in reference. The causal claim of reference cannot provide a way to explain this reasoning semantic ability. The standard development of causal semantics makes it independent of reasoning semantic ability. Causal semantics cannot exclude psychological schemata. The discussion of causal semantics defines "semantics" in a narrower sense and excludes inference intention from the semantic field.

Causal semantics does not believe that reference is the result of psychological schema. Causal semantics also does not believe that reference is the result of language. The concept of referring to something through the mind is a causal relationship with the outside world. According to the view of causal semantics, the reason why a concept means "cow" is not because it can be embedded in a specific syntactic structure or operated through formal reasoning, but because its mark is caused by the cow in the correct way. What ensures this is not the quasi linguistic structure of Fodor's central cognition, but the generalization process of Fodor's perceptual schema.

Conclusion

Common language and quasi language like thinking are cognitive abilities different from schema cognition. They are relatively new additions to the cognitive toolkit. Common language and quasi language like thinking are of little use to animals without sufficient schema forming ability. They inherit a lot of semantic contents from the psychological schema. They do not provide a basis for psychological schemata to produce the same type of reasoning and understanding. However, they are not simply added to cognitive tools alone. They provide different forms of thinking and reasoning and complement the schema-based process. This process enables human beings to improve their psychological schema through more careful and clear examination. Most psychological schemata may be formed without language help. Like many other animals, human beings understand the world through psychological schemata. However, the types of schemata obtained by humans and the methods of processing schemata are more advanced than other animals. This is because humans are animals of language.

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References

Armstrong, D. (1968). *A materialist theory of the mind* (p. 74). London: Routledge.

Block, N. (1986). Advertisement for a semantics for psychology. *Midwest Studies in Philosophy*, *10*, 615-678.

Donald, M. (1991). *Origins of the modern mind: Three stages in the evolution of culture and cognition* (p. 47). Cambridge, MA: Harvard University Press.

Dretske, F. (1988). *Explaining behavior* (p. 27). Cambridge, MA: MIT Press.

Fodor, J. (1987). *Psychosemantics: The problem of meaning in the philosophy of mind (explorations in cognitive science)* (p. 37). Cambridge, MA: MIT Press.

Fodor, J. A. (1983). The *modularity of mind: An essay on faculty psychology* (p. 105). Cambridge, MA: MIT Press.

Ford, J. K. B., Ellis, G. M., Matkin, D. R., Balcomb, K. C., Briggs, D., & Morton, A. B. (2005). Killer whale attacks on minke whales: Prey capture and antipredator tactics. *Marine Mammal Science*, *21*(4), 603-618.

Kripke, S. (1980). *Naming and necessity* (p. 47). Cambridge, MA: Harvard University Press.

Lakoff, G., & Johnson, M. (2003). *Metaphors we live by* (p. 73). Chicago: University of Chicago Press.

Minsky, M. (1985). *The society of mind* (p. 47). New York: Simon & Schuster.

Newell, A., & Simon, H. A. (1956). The logic theory machine: A complex information processing system. *IRE Transactions on Information Theory*, *2*(3), 61-79.

Nieh, E. H., Schottdorf, M., Freeman, N. W., Low, R. J., & Tank, D. W. (2021). Geometry of abstract learned knowledge in the hippocampus. *Nature*, *595*, 80-84.

Putnam, H. (1975). The meaning of "meaning". *Minnesota Studies in the Philosophy of Science*, *7*, 131-193.

Xie, J. H. (2020). *Research on consciousness from the perspective of transhumanism*. Beijing: China Social Press.

Xie, J. H. (2021). The future: A transhumanist approach to consciousness. *International Journal of Social Science and Education Research*, *4*(5), 119-133.