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Cognitive Computing Smart System: How to Remove Ambiguities

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Abstract: The purpose of this paper is to accurately distinguish a series of ambiguities commonly encountered in human-computer interaction through smart system studied and cognitive computing methods, and then make reasonable predictions and responses. The method is as follows: first, make a basic classification of the various ambiguities encountered by cognitive computing and smart systems, then make a corresponding match for each type of ambiguity, and then apply the theory of smart system engineering to guide the translation or interpretation. The characteristic is that the process of prediction and decision-making is the integration of formal methods based on rules and statistics. The result is the discovery of an efficient way to resolve various ambiguities in a trinity of the natural language understanding, expert knowledge expression, and software pattern recognition. Its significance lies in the acceleration of the formation of the disruptive innovation system of the core basic invention of the new general information technology and its supporting software and hardware technologies, and the popularization of the Z standard of cultural gene system engineering practice. In the author's opinion, the first meaning is to regard mind as an attribute of brain, and the second meaning is to further regard language, knowledge, and software as attributes of mind.

Keywords: big data, intelligent information processing, cognitive science and technology, knowledge network and automation

1. Introduction

The biggest ambiguities (covering countless ambiguities) that cognition and computing face together are the mind–body problem in philosophy (Batali, 1995; Searle, 1980) and the artificial intelligence (AI) (Searle, 1998) or mind–brain problem in computer science. This study made a bold hypothesis and obtained a series of enlightening methods and results. Its significance is: understanding it will benefit human intelligence (HI) on a new level, which can be called cognitive intelligence (CI) or collaborative intelligence (CI) or 2CI. The key to the disambiguation in this study is that on the basis of emphasizing the viewpoint of my teacher, Professor John Searle (two or one), it further emphasizes the viewpoint of this study (three or one) (Searle, 2009).

The purpose of this study is to prove such a basic cognitive point of view, that is, with the information processing methods of language, knowledge, and software; following a set of standards, it can be virtually embedded in the human–machine interaction, so as to achieve the purpose of brain–mind integration.

Language (A), knowledge (B), software (C), and hardware (D) are formally combined, following a set of inherent principles. The principle assumes that both the human brain and the computer or machine belong to the large class of brain–computer.

It is characterized in that it has not only attributes such as hardware but also attributes such as software with data or information processing. Among them, language (A) and knowledge (B) usually belong to the two basic attributes of the mind but not the brain. Under special circumstances, they can also be reflected on the computer software (C) with data but not the hardware (D). This can be justified in terms of the class of the brain–computer and its basic categories. In order to prove this hypothesis (point of view), it needs to be verified on specific examples of human brains–computers or machines. The specific verification method is as follows.

As can be seen from Figure 1, brain–mind can not only be regarded as a whole (brain and mind are different in essence) but also can be further decomposed into language, knowledge, and software. In the author's opinion, the first meaning is to regard mind as an attribute of brain, and the second meaning is to further regard language, knowledge, and software as attributes of mind.

2. Literature Review

Obviously, people know too much about the advantages and disadvantages of human intelligence HI and artificial intelligence AI. For example, those experts found the 50 types of cognitive

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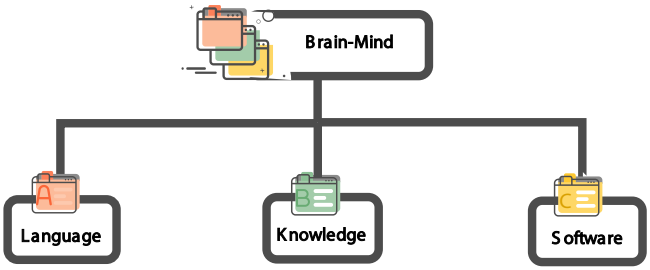
Figure 1
The brain–mind (two-in-one) supported by the synergistic effect of language, knowledge, and software (three-in-one)



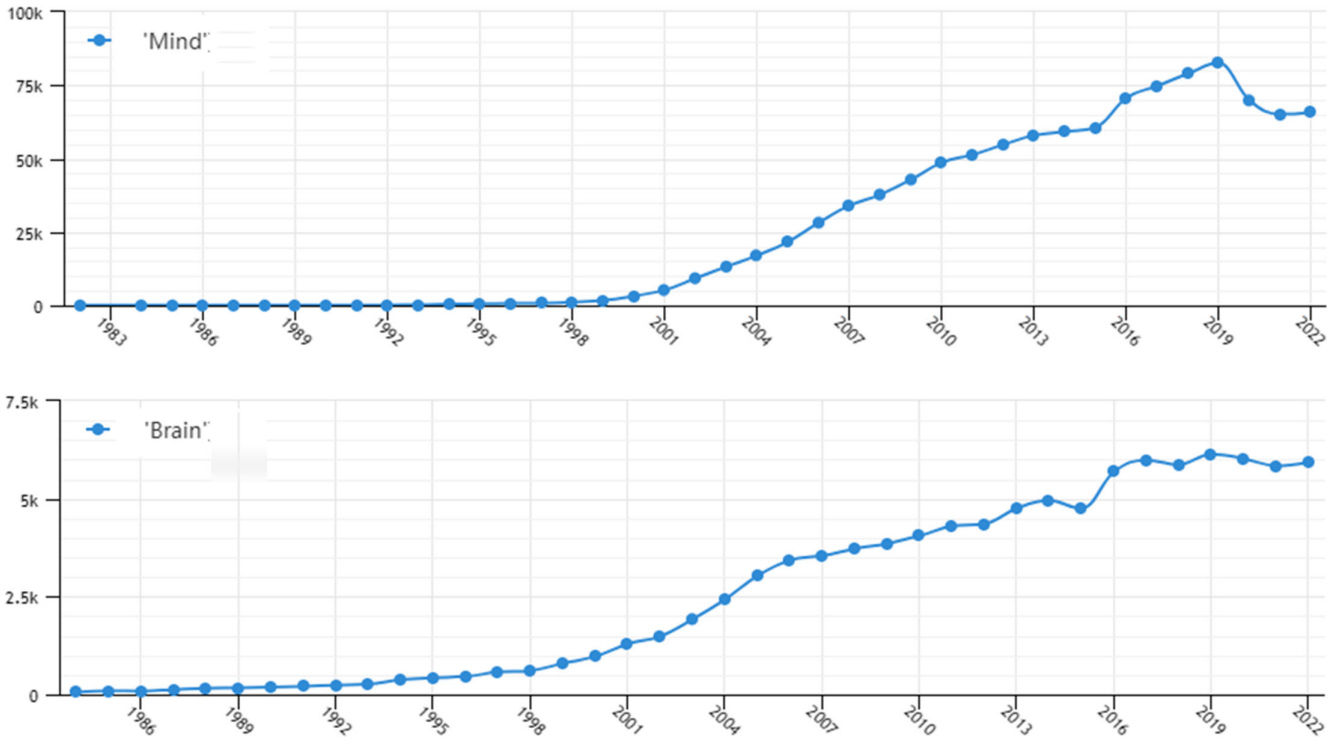
bias that come up nearly every day and that have been identified and listed internationally (Hallman, 1970). Are these really the only ones? Another example is that the most efficient and the best AI machine translation system in the world always makes some jokes in places that people usually do not expect (Gibney, 2016). Why? On the other hand, human experts usually have strong intuition and understanding (Akram & Davvaz, 2012; Isler et al., 2021) why do the vast majority of ordinary people have no or lack of such talents? The top AI systems can not only beat Go champions in the world (Gibney, 2016) but also can do a lot of very professional things (Campbell, 2018; Ferguson, 2018). Do they really have human-like cognitive abilities? (Gibney, 2017; Seife, 2015) Thus, a further question arises: what are the essential differences between human and machine in cognitive systems and information processing capabilities (Ajithbabu et al., 2021; Basu et al., 2021; Bhandari et al., 2021; Malinova & Mendling, 2021; Mikkilineni, 2022)? In computing and statistical capabilities, computer AI expert systems and a new generation of AI expert systems with big data statistics (including formalized classification, matching, translation, prediction, and decision-making) analysis capabilities are indeed far beyond the human level of intelligence (mainly computing, statistics, and learning capabilities). However, only in terms of natural language understanding (Aralikatte et al., 2021; Kwenda et al., 2022; Mazumder & Liu, 2022), expert knowledge expression (Anzai, 2016; Chakraborty et al., 2021; Somogyi & Wolf, 2021; Zimnickas et al., 2019), and software pattern recognition (Doborjeh et al., 2018; Hager et al., 2006; Shen et al., 2021), it can be said that humans and machines have their own advantages and disadvantages. Therefore, this study aims to introduce the basic ideas of what we know about the human–machine collaborative intelligence and typical implementation examples for the cognitive computing and information processing difficulty (Smirnov & Ponomarev, 2021a, 2021b). From the references, we found the pros and cons.

2.1. The old theoretical framework

The old theoretical framework is to study the brain and the mind together, because it is difficult to distinguish. Not only everyday language expressions have vague, ambiguity, and different meanings, but also expert knowledge used as expert terms is difficult to distinguish in most cases. Whether it is the theory of congenital inheritance or the theory of acquired education, learning, and social experience, it is difficult to distinguish the boundaries between the brain and the mind. Even a view of the mind as a property of the brain, like my teacher Searle, is difficult to empirically analyze.

As can be seen from Figure 2, the general trend of the research on mind and the research on brain is similar, but some key turning points are very different.

Figure 2
Network evaluation system based on big data



2.2. The new theoretical framework

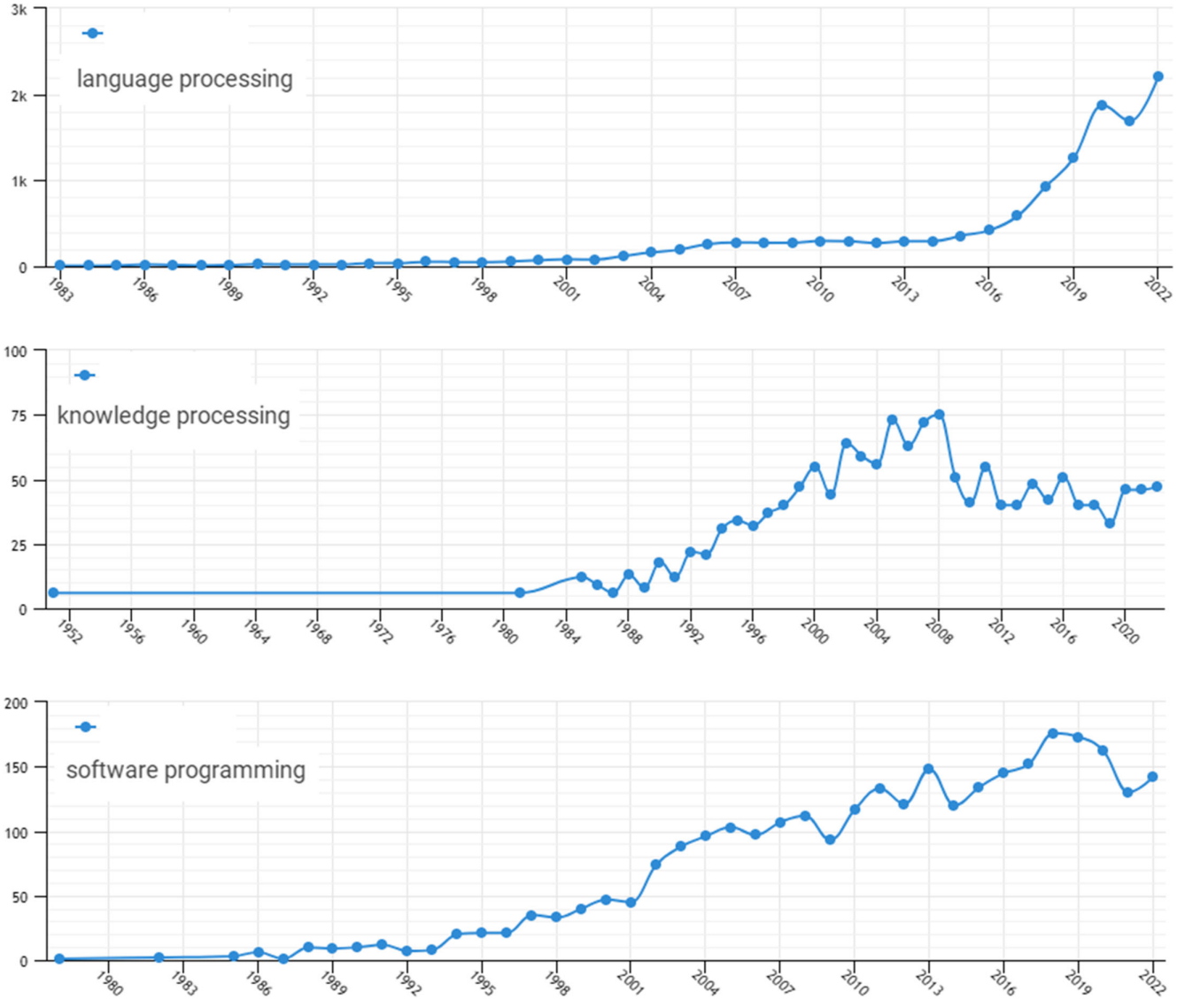
In essence, it not only starts from the standpoint of software-defined hardware, but also goes further, that is, it reflects on the world of time, space, quality and energy from the standpoint of the order, position and information of mathematics and logic, and the three of *God's Wisdom*, Human Intelligence, Artificial Intelligence by using Tao function and its three kinds of thinking coordinates and the new theoretical framework on which it is based. Therefore, language, knowledge, and software are placed in the place of the mind and, thus, beyond the old notion of the brain (*brain and mind*).

As can be seen from Figure 3, the research and development trends of language, knowledge, and software and their interrelationships are very subtle. Compared with knowledge processing and software programming, the research output of language processing is not only an order of magnitude larger in number but also has a significantly different level of complexity. How to distinguish between meaning or doctrine (*-ism*) and ambiguous in the both? What is the difference between meaning and consciousness? How to distinguish between meaning and intent? The most fundamental and biggest ambiguity is encountered here. The difference and connection of the three characters of *Wu-yi-wen* (Physical, meaningful and grammatical) as three types of phenomena; the difference and connection of the three characters of *Li-yi-fa* (Principles of physics, laws of psychology, rules of language) in essence.

3. Research Methodology

The verification method can be briefly introduced as follows: first, HI (*mind*) is regarded as the basic attribute of the brain, and further, AI (*specialized mind*) is regarded as the basic attribute of the computer (*also the attribute of the brain*). Finally, the process of combining human and computer can be focused on the common attributes of brain–computer, among which the most basic attributes are the basic cognitive abilities such as mathematical logical reasoning and numerical calculation.

Figure 3
Theory of planned in this paper as new theoretical framework



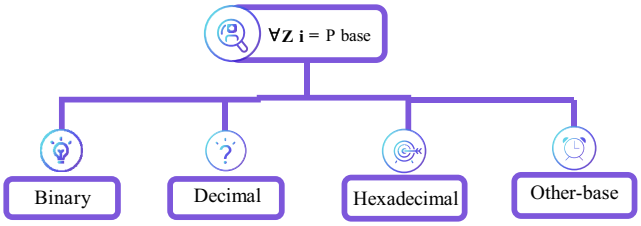
This study starts from such basic reasoning and computation and their equivalent formal classes to demonstrate systematically.

3.1. The Z standard

In this study, the P-system research design (including various systems) is adopted, so that it can be checked at any time.

As can be seen from Figure 4, the various arithmetic bases or systems can be converted to each other, so that cognition can be achieved in the range of mathematical logic. Smart system studied found that the Chinese character system is equivalent to the P-base of arithmetic in the pure form measurement horizon, so the existence variable of mathematical logic is used to record this discovery. Since both humans and machines can recognize and understand the interrelationship between arithmetic bases or systems with 0 and 1 symbols in mathematical logic purely formalized as calculations and deductions, we take this as the starting point for the study of the formal methods described in this paper. We call $\forall_{Z\ i}$ = *P-base or systems* the *Z* standard (*Z-ASCII*) of cultural gene system.

Figure 4
$\forall_{Z\ i}$ = P-base (arithmetic P-base covers all other bases)

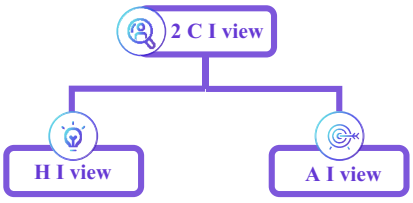


3.2. The viewpoint of *2CI*

The first step in verifying this method is to verify whether it is possible to "*take human intelligence* (*Mind*) *as the basic attribute of human brain* (*Brian*)"? As we all know, we can feel various forms of "*human intelligence* (*Mind*)," but we cannot use physical, chemical, biological, and physiological methods, such as studying brain to study mind and its further manifestations of wisdom, intelligence, consciousness, emotions, will, beliefs, and a variety of cognitive abilities (*collectively referred to as HI*). Fortunately, human beings have invented computer *AI*, which allows us to model, simulate, and compare *HI* and *AI*. Therefore, it is possible to further boldly assume that *mind is the basic attribute of brain*.

As can be seen from Figure 5*, HI* and *AI* can not only constitute *collaborative intelligence* (*CI*) but also have cognitive computing and cognitive reasoning capabilities in arithmetic operations and logical reasoning (*that can be abbreviated as cognitive intelligence (CI)*). Therefore, there is the viewpoint of *2CI* = *HI* + *AI*. It emphasizes that both human and computer have the cognitive computing ability and digital information processing ability of *pure formal symbols 0 or 1* both in arithmetic and mathematical logic. In this sense, this kind of *the cognitive intelligence* (*CI*) shared by HI and AI can be regarded as *the collaborative intelligence* (*CI*) that cooperates with each other, collectively referred to as *2CI*.

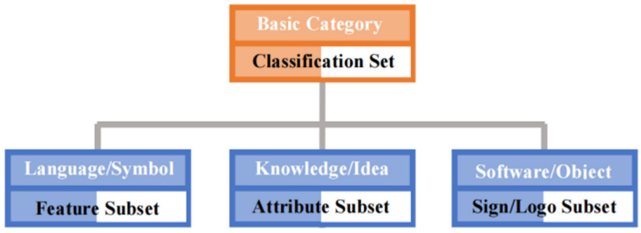
Figure 5
There is the viewpoint of 2CI = HI + AI



3.3. Basic category with *ABC and mind*

As can be seen from Figure 6, the basic categories cover *language, knowledge, software,* and the *classification set* includes three subsets namely *feature subsets, attribute subsets* and sign subsets, choose from a *single set* to a *hierarchical set* that solves the problem of having each factor in its place, then the *categorical set* and its three subsets ensure three broad categories of choice, that each factor according to user's ability, or needs, or want. *Virtual realization is possible, at least in the whole basic category*. All *specific features* (*language/symbols*), *attributes* (*knowledge/ideas*), and *signs* (*software/objects*) are systematically checked by representative users in the relevant field *(preferably with similar majors in each field outstanding classes in representative schools' teachers and students actually participate*) and, at the same time, use the best neural network learning algorithm to participate in the collaborative inspection, thus ensuring its quality and quantity and, in turn, the feasibility, security, and reliability of *brain–Mind* with the network on which it is based.

Figure 6
Virtual realization in the whole basic category

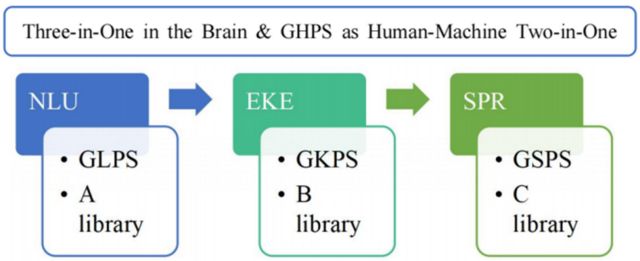


3.4. The core attributes of the mind in both *brain–computer*

As shown in Figure 7, we can see: the *GLPS, GKPS, and GSPS* are *the libraries ABC* that as the three basic attributes of the mind, namely language, knowledge and software all exist in the brain as *three-in-one* in the brain or in *the global hardware positioning system (GHPS) virtually*, not just as human–machine or brain-computer as two-in-one.

Based on the cognitive calculation of *the Chinese character system* (*in library A*) and its implicit *P-base number*, *the library A* of formal understanding of Chinese formal information processing, namely *GLPS*, is established as the international and domestic *Z-L standard* for sequencing and positioning. *The library B*, which is the formal understanding of information processing in the generalized bilingual form of the words and phrases (*including terms and everyday and colloquial expressions*), namely *GKPS*, is established as the international and domestic *Z-K standard* for sequencing and positioning. Integrating software term or knowledge ontology into rich text or media

Figure 7
The core attributes of the mind in both brain–computer



assists the elements in the *library A* (*Chinese characters with ID*) and the tuples in the *library B* (*knowledge or Chinese words and phrases as terminology with ID*) not only to obtain accurate interpretation with texts but also to obtain the supporting of rich text or media systematically generalized translation or interpretation, and in the process of use, rich text with pictures is formed through human–machine dual-brain cooperation, rich media participates in generalized translation or content information processing with generalized interpretation and formal understanding of formal information processing. *The library C of object-oriented understanding* used as the international and domestic *Z-S standard for sequencing and positioning with GSPS*. If necessary, *users* (*ID*) *with HI* and *hardware* (*IP*) *with AI* can be used as the international and domestic *Z-H standards for sequencing and positioning with library D*, namely *GHPS*.

The division and the combination (2CI) of HI and AI with the whole basic category are as follows:

$$Id - Ik = Iu \tag{1}$$

$$A + B = C \tag{2}$$

$$2CI = HI + AI \tag{3}$$

Global data information – Local known information=local unknown information, how to decipher it through *the method of language understanding and knowledge expression and pattern recognition as three-in-one*? And then through the combination of *human–machine as two-in-one* to achieve satisfactory results? The comprehensive advantage of *collaborative intelligence* (*CI*) with *cognitive intelligence* (*CI*) comes from the fact that computer *AI* can simulate the image thinking, abstract thinking, and intuitive thinking of *HI* and then realize it through *three-in-one* and then *two into one*.

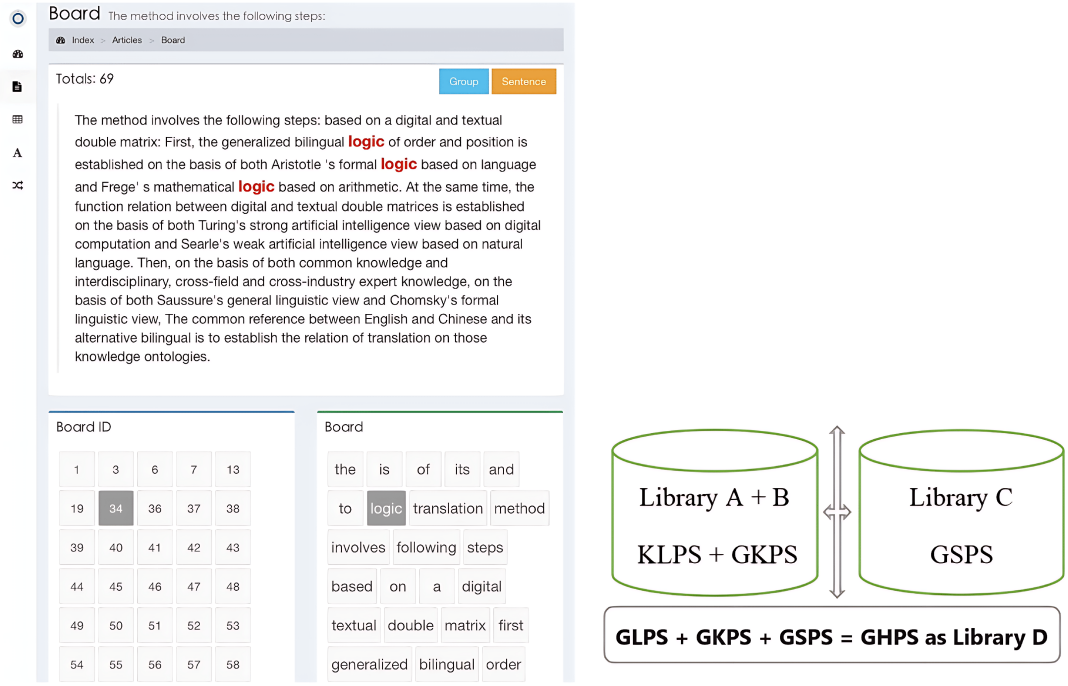
4. Result

The result is that in mind, *GLPS or library A* is the foundation, *GKPS or library B* is gradually formed by reusing it, and *GSPS or library C* is gradually improved by further reusing them. In the end, *all three libraries ABC* are carried by *GHPS or library D*. From the perspective of cognitive computing and information processing, this closed loop is the entire formalized, digitized, and structured intelligent system consisting of language, knowledge, software, and hardware. Among them, *GHPS is the virtual mapping world of Brain*; the embodiment of *its attribute Mind, KLPS + GKPS + GSPS*, is the practical application scenes that all specific *Brain–Computers* can share virtually. The thinking path of each specific user's language cognition is in it. The principle is explained and displayed in Figures 4, 6, 7 and 8. The following thinking attribute coordinates that any user's language cognition can be recorded.

4.1. The typical example

As shown in Figure 8, we can see: *both the library A and the library B* have been completed, with *the whole process of digitization, structuring, and indirect formalization*, and *the*

Figure 8
The typical examples: GLPS + GKPS + GSPS = Mind and Brain = GHPS



library C has also been proved feasible by various tests and is not only a process that is gradually established and perfected in the process of reusing *the library B*, but also it self can be reused by *the library D* or *our users*. Since *the libraries ABC* are aimed at establishing *Z standards*, the continued establishment and promotion of *the library D* is essentially a process of combining personalization and standardization. Therefore, demonstration models for various user groups are urgently needed. Thus, form the entire social systems engineering of language education, knowledge management, learning and using of software and hardware, in conjunction with the formalized systems engineering of language understanding, knowledge representation, pattern recognition of both software and hardware. During this process, *the positive effects of KLPS + GKPS + GSPS* and *the sequencing and positioning of GHPS* can be highlighted anytime and anywhere, then, their advantages can be exerted popularly.

4.2. Scientific principles on which it is based

As shown in Figure 9, we can see: *the three-dimensional coordinates* composed of *Cartesian number axes* (*the lattice sequence below represents the spaces of the double list, the twin Turing machine*) and *three types of thinking attributes* with *mind categories* (*A, B, C,+ Relation*) displayed *in* Figures 5, 8, and 9.

The *X-axis* represents *the factor space P* (*W*) *of image thinking, the Y-axis represents the factor space G* (*L*) *of abstract thinking*, and the *Z-axis* represents *the factor space M* (*T*) *of intuitive thinking or inspirational thinking*. The three number axes are combined to form coordinates that can qualitatively and quantitatively express three types of thinking attributes (*the three-dimensional coordinates composed of Cartesian number axes*). Each *factor space* can also adopt *the multi-dimensional form of the factor space* (*here using Hilbert space means converting to multi-dimensional space*). Among them, the large and small triangles of the two sections can be regarded as *two mathematical categories, respectively*, they stand for *object, entity,* and *ontology*, and the connecting line stands for *relation*, the small triangle represents *the initial category*, and the large triangle represents *the final category*. They can represent *the starting and ending categories* of *three types of human thinking in mind*, covering *individuals and groups*. The effective *three types of thinking factor space* for each person must be included in *the basic attribute space* of the triangular prism between the large and small triangular pyramids and the entire range of *factor space* it contains. A separate *Cartesian number* line on the side has *a zero* (*O*), the direction of the arrow is positive, and a row of small squares below it is a countable square (*each of which is not only compatible with the natural numbers. There is a functional relationship between them, and it can also be regarded as a Turing computable number. Furthermore, it can be regarded as a natural number computable functor of the twin Turing machine that can satisfy the conversion between various bases and its corresponding specific factor or attribute or sign or characteristic)*.

Concepts have not only connotative properties but also denotative classifications. Moreover, both attributes and classifications are uncertain, which reveals the specificity of intuitive thinking. It can be seen that among the three types of human thinking, intuitive thinking itself is produced by the combination of abstract thinking and image thinking. Therefore, no matter it is the thinking coordinates of macro and micro, it can also record the category of human thinking.

4.3. The combination of smart system studied and category theory

As shown in Figure 10, we can see: it is really powerful for the difference and connection between the basic categories (*A, B, C, relation:* I_d, I_k, I_u) both in the smart system studied and in the mathematical category theory (*category = object + relation*). The mystery or principles of Mind as Brain's attribute, especially language, knowledge and software, are further regarded as the attributes of mind, well interpreted in Figures 1–12 can be a landmark.

Figure 9
Three types of thinking attributes with mind categories (A, B, C, + Relation)

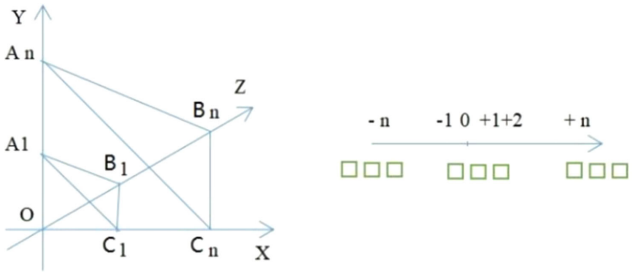


Figure 10
Category = Object (A, B, C) + Relation (f, g, gof)

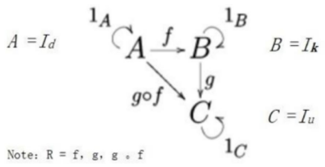


Table 1
Smart system from virtual to reality gradually

Smart system	Smart system studied with their example	Manifestations
Library A GLPS	Global language positioning system	Natural language understanding
Library B GKPS	Global knowledge positioning system	Expert knowledge expression
Library C GSPS	Global software positioning system	Software pattern recognition
ABC three-in-one (it is equivalent to the trinity in mind.)		
Library D GHPS	Global hardware positioning system	Human–machine *Brain–computer two-in-one virtually*

The data I_d generated by the invocation of *the library A* are not only recorded in *GLPS* but also can be invoked by users to become the foundation and basis for constructing *the library B* to form *GKPS* and then indirectly support the construction of *the library C* and the formation of *GSPS*.

Improve the results and discussion section in this paragraph that means Chinese literacy can be measured and evaluated automatically here. Based on literacy, the number of vocabulary and terms can be calculated and counted (*then the automatic evaluation of knowledge can be achieved*) (Zou & Zou, 2017). These are the two basic and important practical application scenarios of this study (*other languages have no such convenience as Chinese characters and Chinese language*) (Zou et al., 2019).

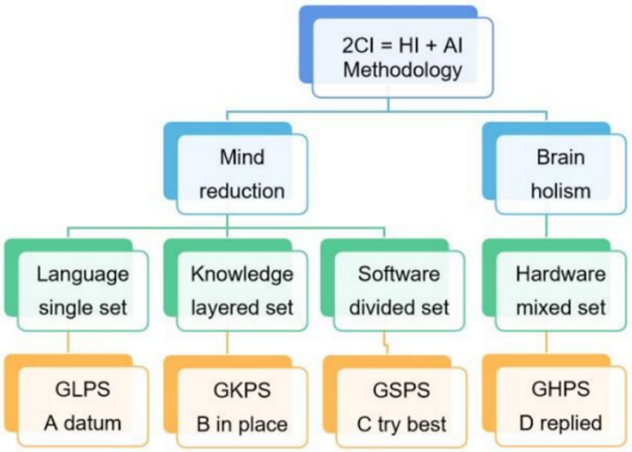
5. Conclusion

The conclusion is that *Mind as Brain's attribute* is not only a theoretical hypothesis but also can be transformed into facts through a series of standard virtual construction processes and then realizes its role and value through popularization and application. This is the point of this study.

5.1. *The library A* is the first, followed by *the three libraries BCD*

As can be seen from Figure 11, its significance lies not only in the first virtual realization of efficient collaboration between human–machine and dual-brain both in brain–computer as the *GHPS*, the level of Internet of Things interconnection will also be greatly improved, and *the language library A as GLPS*, *the knowledge library B as GKPS, the software library C as GSPS* as three-in-one global large-scale cross-border integration and collaboration, for the further realization of the efficient popularization of cognitive computing and information processing technology standards *Z (-L,-K,-S)* and application examples of the *library D* and three intelligent attributes in mind as the *three libraries ABC*, laid the theoretical foundations and practical foundations (Table 1).

Figure 11
The library A is the first, followed by the three libraries BCD



5.2. The P-base in mind as mathematical and logical properties

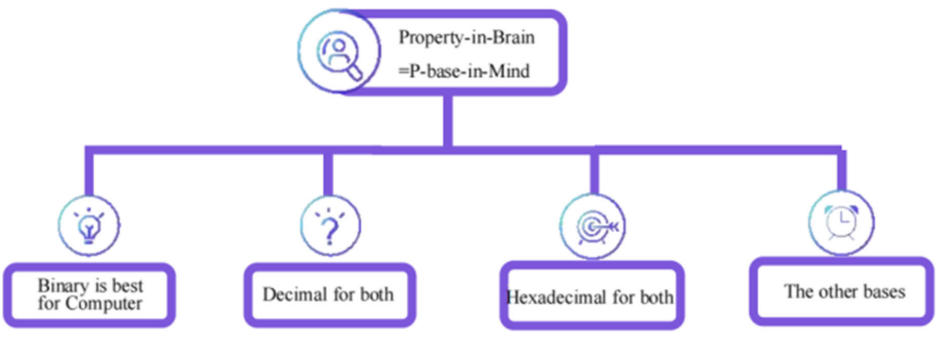
As shown in Figure 12, we can see: the computer using the simplest binary notation system and the most complex *P-base* notation system (*the Chinese character system as indirect formal system*) is perfectly combined in the dual formalization system (*also see* Figures 8 and 9). The binary is best for computer and *the P-base* is best for the Chinese character system users, that is to say the properties in brain can be simplified to *the P-base in Mind* as human brain's attributes that have been shown both mathematically and logically.

The future scope of our present works is mentioned in this paragraph. Based on the automatic evaluation of Chinese characters, it can play a role in smart phones and various voice sensors or AI systems anytime and anywhere. Combined with the ID for the smart system users and the universal use of various computer networks, mobile networks and the Internet of Things combined with the real name system, the *GLPS* based on Chinese characters and the *GKPS* based on Chinese vocabulary or terminology applications echo each other from afar, that is, the big data that the *GSPS* and *GHPS* have been batch processed or human–computer interaction processed will be automatically collected and analyzed by AI system, push to each registered user and their AI agent. This future prospect will bring many unexpected gains.

Recommendations

From the dualism of mind and body proposed by Descartes to my teacher John Searle's Chinese Room Argument (*discussion on the Turing test, whether the computer has the ability of the human brain to understand natural language as the criterion for distinguishing between strong AI and weak AI*), further, consider the mind as a property of the human brain. It is the starting point of this dissertation. The solution proposed in this paper is to

Figure 12
Binary is best for computer as P-base in mind for brain



regard the ability of language, knowledge, and software to process information collaboratively, not only as an attribute of the mind but, furthermore, as the three basic factors of the mind. Therefore, the three-dimensional coordinates composed of the three types of thinking vectors described in this paper can not only be called thinking coordinates, but each type of thinking number axis can be further developed into a series of *factor spaces* (*the vector space can be regarded as a special case*).

Acknowledgments

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Ethical Statement

This study does not contain any studies with human or animal subjects performed by any of the authors.

Conflicts of Interest

The authors declare that they have no conflicts of interest to this work.

Data Availability Statement

Data sharing is not applicable to this article as no new data were created or analyzed in this study.

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