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The Relationship Between Language and Speech: Formal Understanding of Natural Symbology

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The Relationship between Both Language and Speech: Formal Understanding of Natural Symbology

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Abstract. This paper aims to realize the natural language formal understanding through the mathematical logic principle of indirect formalization for Chinese and its characters, and its essence is to understand the relationship between language and speech. The method is: First, it is clear that monosyllabic Chinese characters have two basic attributes of language and text, the text characteristics of English letters and English morphemes, words, phrases and sentences, which belong to another type of text and language; further, it is clear that the large and small strings of mixed syllables belong to two different speech, such as Chinese and English; finally, it is further clarified that monosyllabic and mixed syllables not only have the interpersonal communication, but also have human-computer interaction helped with batch processing, its fundamental feature is that the monosyllabic Chinese characters meet a certain arithmetic base that is indirectly formalized with the typical P base. As a result, it was unexpectedly discovered that arithmetic and language have rigid constraints on the underlying sequence-position logic and surface linkage functions, but there are flexible rules for broad interpretation or translation for the symbolic objects of their division and combination. Its significance lies in: sequence-position logic, linkage function, broad translation or bilingual or language, in essence, from the macroscopic global to the microscopic local, to systematically formally understand natural language, especially to thoroughly understand the relationship between Chinese language and speech, that is, a transparent way to understand natural language, namely: Global Chinese Sequencing and Positioning System.

Keywords: First Keyword, Second Keyword, Third Keyword.

1 Introduction

This paper aims to realize the natural language formal understanding through the mathematical logic principle of indirect formalization for Chinese and its characters, and its essence is to understand the relationship between language and speech.

It is found that in the past, Chinese was regarded as a monosyllabic language and English was regarded as a polysyllabic language which is a complete misjudgment.

To realize the formal understanding of natural language through the mathematical logic principle of indirect formalization of Chinese characters and Chinese words, and its essence is to understand the relation between language or Yan and speech or Yu. The background involves not only Saussure's analogy between language and chess as two systems, but also Wittgenstein's language games, and the formal languages of Tarski and Carnap (object language and metalanguage cum interpreted language) and Chomsky (NP+VP=S). [1][2][3][4][5][6][7][8][9][10][11][12]

Table 1. The original creators and their classical theoretical principles.

ID	original owner	The classical theoretical principles	All one's life
1	Saussure	Who used chess analogy for language	1857-1913
2	Wittgenstein	Who came up with the language game	1889-1951
3	Tarski	Who used object language and metalanguage	1902-1933
4	Carnap	Who used object language and metalanguage	1891-1970
5	Chomsky	Who used Noun Phrase + Verb Phrase = Sentence	1928-

It can be seen from Table 1 that the focus of this research, the following discussion is almost all around the core issues. Question 1: Why do language and chess have similar meanings of reasons or laws and not just rules? Question 2: Why are language games and board games so similar? Question 3: In terms of linguistics and philosophy of language, is this different way same return as the same thing? Question 4: Why do philosophers of language, mathematics, and science focus once again on the nature of language in explaining? Why can its formal characteristics be accurately transmitted across subjects? For example: formal interpretation of symbolic objects and their combinations. This is question 5 and its example interpretation. In theory, what is language? Or, what is the language? The question of the nature of language (5 and 6), which is a sufficient and necessary argument, is highlighted here! The following discusses from the relationship between language and speech, and further extends to the relationship between Yan and Yu.

2 Method with Examples

The method is as follows: First, it is clear that monosyllabic Chinese characters have two basic attributes of language and text at the same time, the text characteristics of English letters and the language characteristics of English morphemes, words and phrases or sentences, which belong to another type of text and language. Furthermore, it is clear that large and small strings of mixed syllables belong to two different languages, such as Chinese and English. It is found that in the past, Chinese was regarded as a monosyllabic language and English was as a polysyllabic language, it is a complete misjudgment; finally, it is further clarified that monosyllabic and mixed syllables are not only unique in terms of interpersonal communication in Chinese, but also unique in human-computer interaction and even in automated batch processing,

its fundamental feature is that the monosyllabic Chinese characters satisfy the specific arithmetic base, that is, the typical P base. [13][14][15][16][17][18][19][20][21][22]

2.1 The Indirect Formal Understanding

Table 2. Comparing Chinese and Western languages, it is found that the fundamental difference in form lies in the syllable system.

ID	English	Syllable system	Chinese	Syllable system
0	morpheme	Monosyllable	morpheme	Monosyllable
1	language	Remix syllable	Yan / language	Monosyllable
2	speech	Remix syllable	Yu / speech	Remix syllable
2.1	word	Polysyllabic	word	Polysyllabic
2.2	phrase	bi- / polysyllabic	phrase	bi- / polysyllabic
2.3	sentence	Polysyllabic	sentence	Polysyllabic

It can be seen from Table 2 that the fundamental difference in the form between Chinese and Western languages which lies in the syllable system, that is, there are fundamental differences in the form of phonetics and phonemes between the monosyllables in Chinese and mixed syllables in Western languages. The two aspects are distinguishable in form (not only the textual difference between large and small strings, but also the linguistic difference between monosyllabic and mixed syllables, which can be clearly shown in Table 2 only after the relationship between speech and language is clear, Otherwise, since morphemes are both monosyllabic, it is difficult to distinguish).

Yan / Language. It is clear that monosyllabic Chinese characters have two basic attributes of language and text at the same time, the text characteristics of English letters and the language characteristics of English morphemes, words and phrases or sentences, which belong to another type of text and language.

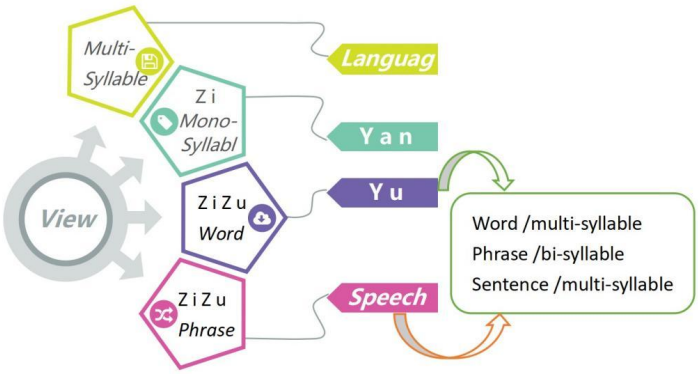

Fig. 1. Monosyllables and mixed multi-syllables belong to different categories

It can be seen from Figure 1 (combined with Table 2) that the mixed syllables of Western languages and the monosyllables of Chinese languages belong to different formal categories; while the speech of mixed multi-syllables and the basic division of Chinese in ordinary languages (words, phrases, sentence) belong to different formal categories, above have tended to be consistent (the difference formally is only in the difference between small strings as language&speech and large strings as Yan&Yu).

It can be seen that monosyllabic Chinese characters have the duality of language and its writing form-character.

Yu / Speech. It is clear that large and small strings of mixed syllables belong to two different languages, such as Chinese and English. It is found that in the past, Chinese was regarded as a monosyllabic language and English was as a polysyllabic language, it is a complete misjudgment.

Size (big&small) strings of mixed syllables: two categories of speech paradigms

It is clear that the large and small strings of mixed syllables belong to two different languages, such as Chinese and English. It is found that: in the past, Chinese was regarded as a monosyllabic language (in fact, it should be a monosyllabic language and a mixed speech), and treating English as a polysyllabic language (which should be a mixed-syllable speech) is a complete misjudgment. Correct them, not only for language teaching, but also for the natural language processing, especially Chinese information processing and its formal understanding. [23][24][25][26]

Monosyllabic and mixed-syllable speech: Indirect P base. It is further clarified that monosyllabic and mixed syllables are not only unique in terms of interpersonal communication in Chinese, but also unique in human-computer interaction and even in automated batch processing, its fundamental feature is that the monosyllabic Chinese characters satisfy the specific arithmetic base, that is, the typical P base.

Machine learning. The basic difference between classification and clustering:

By training&learning on data of known classes, find features of different classes, and then classify unclassified data. Taking text analysis as an example, it is to classify texts into existing categories according to their characteristics or attributes. In other words, classification deals with: known data, objects or users. Classification belongs to supervised learning. Common classifications include: decision tree classification algorithm, Bayesian classification algorithm, etc.

The problem with clustering is that we don't know how many classes the data can be divided into. Clustering is the aggregation of data, objects or users into several groups, therefore, it does not require training and learning on the data. Clustering belongs to unsupervised learning. Common clustering includes: the most basic system clustering, K-means clustering and other algorithms.

Table 3. The basic difference between classification and clustering.

ID	Types	Data types	Machine learning types	Learning algorithms
1	Classification	Classified data	Supervised learning	Decision tree； Bayesian
2	Clustering	Unclassified data	Unsupervised learning	K-means; Basic clustering

Classification must know the information of each classification clearly in advance, and be able to judge that all items to be classified have corresponding classifications. As far as languages are concerned (such as Chinese and English), at the language level, the uniqueness of Chinese lies in the fact that characters have the basic attributes of characters, morphemes and languages; while foreign languages such as Western languages, English, are characterized by the letters and morphemes of the characters. There are only a few monosyllabic words or sentences in the two basic structural units, while the two-syllable and multi-syllabic words or sentences are the vast majority. This has at least clearly demonstrated the major differences between Chinese and foreign cultures at the level of language and speech. Furthermore, to understand the distinction between Yan and Yu, at least one step further than the distinction between language and speech! Why can Chinese characters and Chinese speeches be further differentiated in basic language theory than in ordinary linguistic theory? Not only is this question worth digging into, but it can be investigated and verified anytime, anywhere with today's web language analysis tools. **Clustering** should not only satisfy the most typical K-means algorithm, but also satisfy various algorithms of division and hierarchy, density-based or grid-based or a certain model. If the analysis of texts both in Chinese and English is done with the introduction of word segmentation and tagging techniques, the respective advantages or differences of clustering and classification will be obscured. Suddenly, you fell into the semantic quagmire, pragmatic traps, grammatical circles of Western languages, and it was difficult to extricate yourself, why? Because, consciously or unconsciously, the advantage of Chinese characters and Chinese speeches has become a disadvantage all of a sudden!

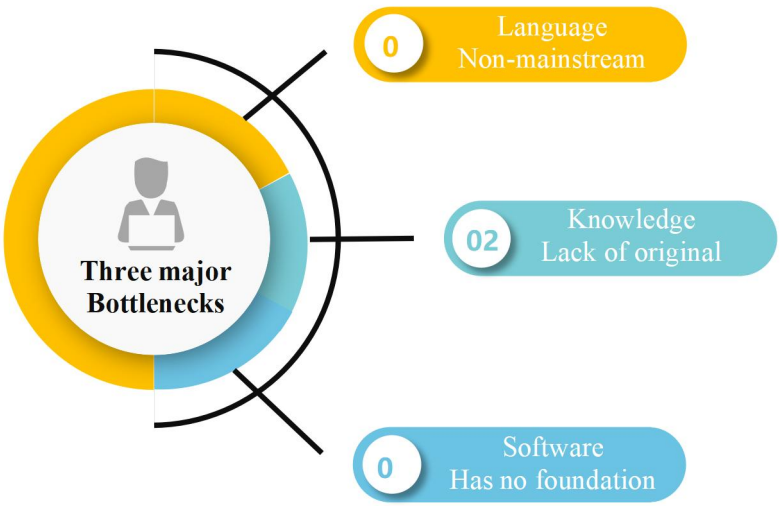

Fig. 2. The old language view has led to three major bottlenecks in Chinese characters and Chinese speeches for a long time

It can be seen from Figure 2 that the three major bottlenecks faced by Chinese characters and Chinese speeches for a long time are essentially the inevitable result of the old language view. Combining Table 1 and Figure 1, it can be seen that the division of language and speech is the concentrated expression of the old language view; although the division of language/Yan and speech/Yu is the embodiment of the new language view, it is still far from universal. Therefore, three bottlenecks still exist: *One of the bottlenecks* is that in the international context, in the process of interpersonal communication, English is the mainstream, and Chinese is not; *The second bottleneck* is the development of ancient Greek philosophy to modern science, and the originality is from Europe and other countries rather than China; *The third bottleneck*, from the perspective of ASCII the American Standard Communication Interchange code for human-computer interaction, the Chinese national standard GB is a plug-in, and the OS is a translation (the same is true for other imported software at all levels). Therefore, it is bound to be limited by the three major bottlenecks, and there is no initiative at all. Of course, if only look at it from the perspective of zero-sum game, then from the point of view of the dominant country, we tend to ignore the double-sidedness of the three bottlenecks, especially when we find that the distinction between language/Yan and speech/Yu has a new perspective on language. After the unique advantages, the new global pattern of human-computer interaction of non-zero-sum game can complete the first big leap in human cognition (with mixed advantages and disadvantages) and sublimate to the second great leap in human cognition! Only then the zeroth great leap of human cognition (occurring only in a local area and not forming the common sublimation of the global cognition of all human beings) can be absorbed.

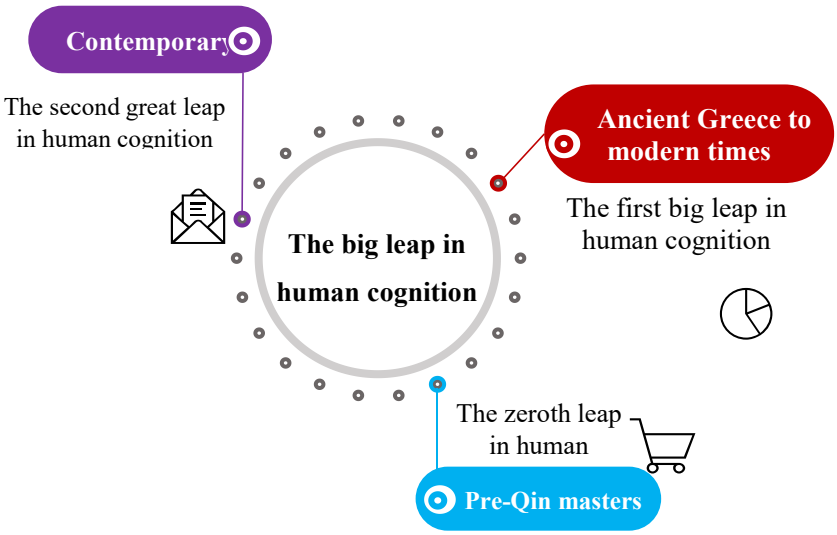

Fig. 3. The three big leap in human cognition

As can be seen from Figure 3, only when all countries in human beings have the new thinking and cognition level of non-zero-sum game, that is, they can take the initiative to break through the language bottleneck, the knowledge bottleneck and the software bottleneck (the three deep-level bottlenecks) between each other. Finally break through the hardware bottleneck of the relationship between man and nature (covering artificial, humanities and society)! The core of this is that the basic barriers between the two major languages have not been completely broken through. The second great leap in human cognition and the process of intellectual integration provide a once-in-a-lifetime opportunity!

2.2 Monosyllabic language and mixed-syllable speech: Indirect P base

It is further clarified that monosyllabic speech and mixed-syllable speech are not only unique in terms of interpersonal communication in Chinese, but also unique in human-computer interaction and even in automated batch processing. The fundamental feature is that : The single-syllable Chinese characters satisfy the arithmetic base of indirect formal understanding, that is, the typical P base. The relational database of language and speech has realized two categories of direct and indirect formalization: digitization, symbolization, structuring (see the embodiment in Figure 4 below).

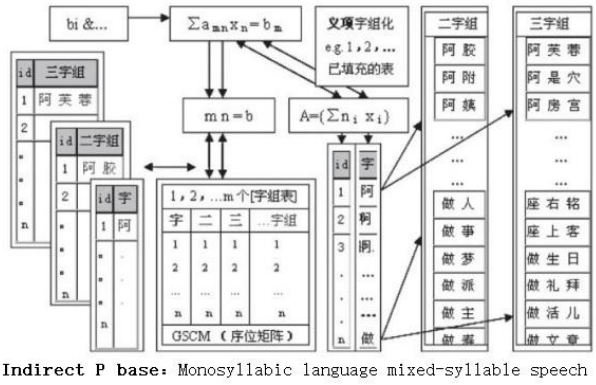

Fig. 4. The relational database of single-syllable language and mixed-syllable speech.

It can be seen from Figure 4 that monosyllabic languages (Chinese characters with dual attributes of text and language have both an object language and a first-level interpreted speech as metalanguage) cover all Chinese characters; the mixed-syllable speeches cover all levels of interpreted speeches or metalanguage (and both have been doubly formalized, both directly and indirectly, that is, Figure 4 shows more than just a typical example of a language-to-speech relationship, that is, a relational database of words and groups of words, moreover, it is also an example and theoretical model or schematic diagram of a global language sequencing positioning system in Chinese).

Monosyllabic Language to Speech: A Single Set as Indirect P System

Each Chinese character, that is, a single-syllable language to speech, has a unique ID code, so a single set of elements of P units is formed with the decimal numbers: the synonymous parallel correspondence conversion relationship within the P system, that is the global constraints of a fundamental information law are satisfied, and thus, a formal understanding can be achieved. That is to say, in the process of human-computer interaction, the basic division of labor is: users recognize/reuse Chinese characters; the machine only needs to recognize the unique ID number of Chinese characters and no matter what system it uses, it can be quickly identified through the linkage function within the P system. Automated batch processing (also semi-automated with human-computer interaction).

Mixed Syllables Speech: a Series of Hierarchical Sets as Indirect P Systems

Chinese characters group of mixed syllables, that is, the words of mixed syllables, are arranged in a series of hierarchical sets according to the tuples of P units in the *O* lists of single and polysyllables, and are also formed with decimal numbers: *N* or *M* The synonymous juxtaposition corresponds to the conversion relationship in the P system or the agreement juxtaposition corresponds to the conversion relationship in the P system, that is, the global or local constraints of the two basic information laws are respectively satisfied, so that not only the global formal understanding can be realized, but also the local can be realized with objectification and even conceptual understanding. The basic division of labor in the human-computer interaction process is not only literacy as letters or strokes, but also quantitative recognition of words, phrases, and sentences. In the same way, the machine only needs to recognize the unique ID number of Chinese characters and Chinese speeches (the sub-tables at each level and the sequence position of each relevant grid inside), and no matter what system they use, they can quickly pass the linkage function within the P system. Recognition is automated batch processing (and can also be semi-automated by human-computer interaction), the difference is that the algorithm is more complex.

$$N^x + M^y \leq O^z \tag{1}$$

$$NP^x + VP^y \leq S^z \tag{2}$$

$$HI^x + AI^y \leq SI^z \tag{3}$$

Equation (1) combined with Figure 4 shows that *N&n* is the digital variable of the row, *M&m* is the digital variable of the column, and *O* is the digital variable of all symbolic objects in the row and column. In other words, the three variables in *formula (1)* and their unknown exponents or circular logarithms are all variables, and the meaning and purpose of their expressions can be formally understood in a specific domain of definition and value range. The order lattice and its algorithm path locked by the specific row and column it refers to are naturally clear. *Equation (2)* is an upgraded version of the generalized formula of noun phrases (*NP*) and verb phrases (*VP*) and the sentences (*S*). Human Intelligence (*HI*) and Artificial Intelligence (*AI*) and their cognitive or collaborative Synergistic Intelligence (*SI*) capability are a generalized and upgraded version of the formula formed by the system science

principle that the sum of the parts is equal to and less than the global,that is, the whole is greater than the sum of its parts. The specific algorithm is in the supporting treatise.

3 Result

As a result, it was unexpectedly discovered that arithmetic and language have rigid constraints on the underlying sequence position logic and surface linkage functions, but there are flexible rules for broad interpretation or translation for the symbolic objects of their division and combination. This leads to the three basic laws of logic, mathematics and generalized bilingual interpretation even the formal understanding of natural language and its translation or formal interpretation.

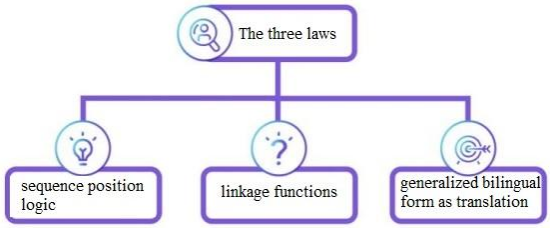

Fig. 5. The three basic laws of intelligent integration

It can be seen from Figure 5 that the first basic law, that is, the unique conservation of the ordinal relationship, is valid not only for arithmetic but also for the relational database, especially Chinese characters and speeches, within the range of the P base. The second law is that the conversion of synonymous juxtaposition not only directly and indirectly covers a series of minor premise within the range of P base, but also it directly or indirectly does automatic conversion between various base symbol systems. Combined with the third basic law, in the application scenarios of interpersonal cooperation and human-computer interaction, the joint cognitive goal of human-computer interaction and batch processing can be locked in accordance with the development of parallel corresponding transformation bilingually. The multiple sets of relational databases described in conjunction with Figure 4 can be verified.

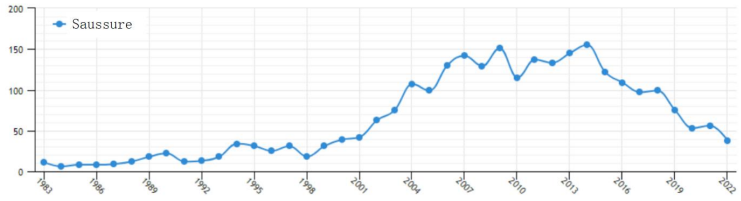

Fig. 6. The development trend of Saussure research

As can be seen from Figure 6, the development trend of Saussure's research, it shows that: Saussure's research and its trend has indicated its characteristics of falling. It is compared with the development and change trends of various research directions such as Wittgenstein, Tarski, Carnap and Chomsky (respectively presented by Figure 7, Figure 8, Figure 9 and Figure 10) , will find the focus of this research.

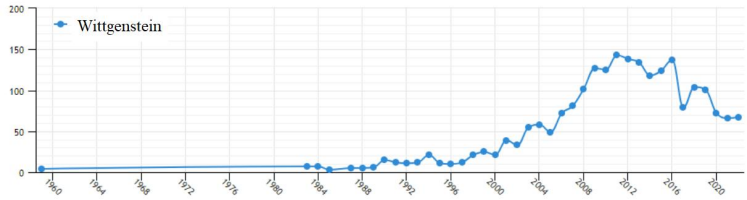

Fig. 7. The development trend of Wittgenstein research

As can be seen in Figure 7, the comparison between the development trend of Wittgenstein's research and the development trend of Saussure's research in Figure 6 shows that a very subtle situation has occurred recently. Figure 6 and Figure 7 are so different in two aspects. What is the reason behind it? Worth pondering. Suppose rational reflection is more essential and more important.

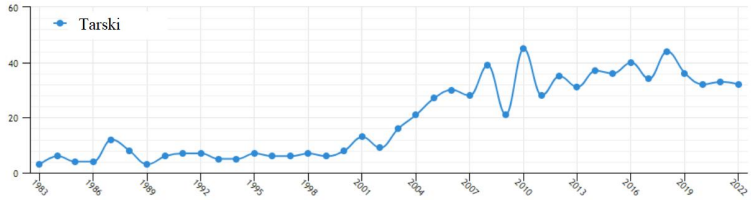

Fig. 8. Development Trend of Tarski Research

As can be seen from Figure 8, the trend of Tarski's research has leveled off.

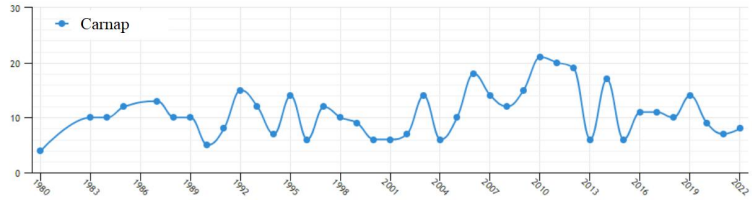

Fig. 9. Development Trend of Carnap Research

It can be seen from Figure 9 that the development trend of Carnap's research has large fluctuations in high and low changes. Comparing Figure 8 and Figure 9, a very interesting phenomenon is formed. There is a contrast between academia's concern with formal research with content. What does this mean? Great inspiration for this research. It can be seen from Figure 10 that the characteristics, attributes and signs of the development trend of Chomsky's research are very different from those of the previous ones, but the general trend is similar to that of Saussure.

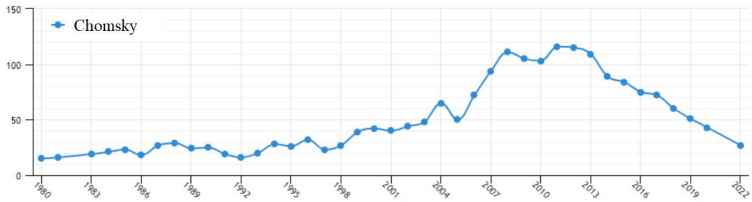

Fig. 10. The development trend of Chomsky research

Table 4. Comparative analysis of the five group trends of related research fields.

ID	Five scholars	Comparative analysis of the trend of the five groups	
1	Saussure	Growth in 20th and early in 21st	Declining in recent years
2	Wittgenstein	Grown rapidly since the 21st	Fallen in recent years
3	Tarski	Growing twists and turns since the 21st	Stabilized three years
4	Carnap	Rose and fell at the end of the 20th	Declined in recent years and then increased slowly
5	Chomsky	Growth peak since the 21st	Declining in the past decade

It can be seen from Table 3 (combined with Figure 6-10) that the development trend of the five groups of related research fields is compared and analyzed. A series of interesting phenomena have been found. The most typical of them are the research trends of Saussure, Wittgenstein and Chomsky; the research trends of Tarski and Carnap rise and fall (deserving special attention). This also confirms the original approach and unique value of the focus of this study.

Further analysis and discussion

The result is that a further discovery the application scenarios of human-computer interaction / computer assistance now have the conditions for large-scale development and verification of human knowledge modules, and at the same time, the application scenarios of AI and educational informatization also have the ability to facilitate group or collective not just individual intelligence. Development and even potential development and the conditions for its significant improvement.

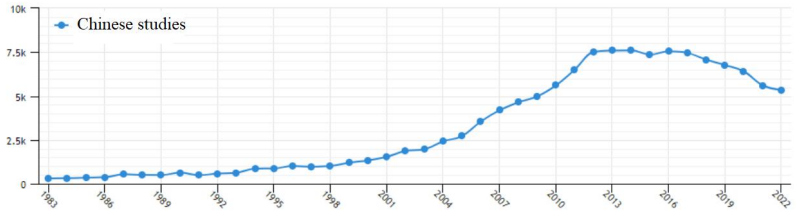

Fig. 11. The development trend of Chinese studies

It can be seen from Figure 11 that the development trend of Chinese studies has been increasing in this century and has reached a high level in the past decade.

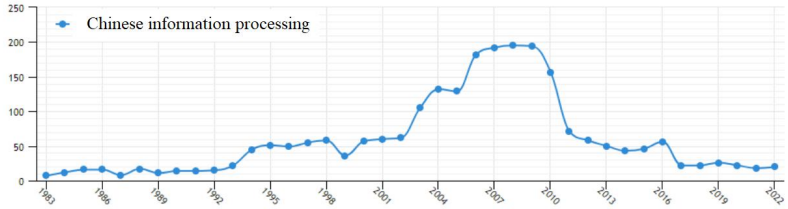

Fig. 12. The development trend of Chinese information processing research

As it can be seen from Figure 12, the development trend of Chinese information processing research has peaked for several years in the first decade of the 21st century, and has been stable and sluggish in recent years.

Why? How to do it? when? where? Who will lead? It is necessary to find out whether the limit of human cognitive growth can be truly broken! This requires readers to review how the first great leap in human cognition created miracles, and how it made breakthroughs in historical retrospectives where the impossible became possible. Please take a look at Chinese information processing.This gives the unique approach of this study a great opportunity to unleash talent. After the theoretical breakthrough of the relationship between language and speech, especially after the actual verification of the relational database of Chinese language as Yan and speech as Yu, this research has made great progress (see Figure 4).

4 Conclusion

Its significance lies in: the sequence position logic, linkage function, generalized language/translation/bilingual relational database, in essence, it is a systematic and formalized understanding of natural language from the macroscopic global to the microscopic local, especially the thorough understanding of the relationship between Chinese language and speech, that is, a transparent way to formally understand natural language is to construct a global Chinese sequencing and positioning system. Chinese language and speech have such a way, which is not found in other languages. The research breakthrough of basic theory and the verification and development of practical technology are beneficial to further popularization and application and theoretical research in a wider range and deeper level.

Fig. 13. shows the double-character chess processing of classical Chinese

As can be seen from Figure 13 above, Figure 14 and Figure 15 below, how Chinese characters as Yan and Chinese speeches as Yu used the double-character chess theory to reflect the dual formalization of the combination of numbers and characters with the relational database displayed in the background of Figure 4, can better understand the diagram. The

foreground operation situation shown in 13-15, the way of calling the relational database of Chinese characters as Yan and Chinese speeches as Yu that equivalent to word groups.

Fig. 14. shows an example of the processing of double-character chess in modern Chinese

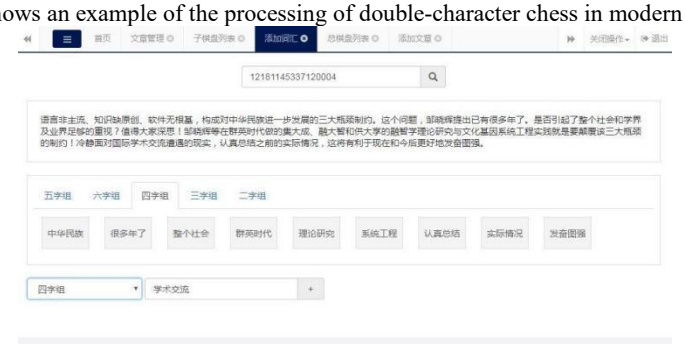

Fig. 15. shows the processing of double-character for each level of word groups

If Figure 4 (macro-global) and Figures 13-15 (micro-local) reveal the three basic laws of Yan and Yu sequence position logic, linkage function, generalized bilingual or translation, and the supported global Chinese sequencing positioning system model the scientific principle is the law, then, the development environment of the software system development environment and the realization of GSPS the global sequencing positioning system and the realization of the global sequencing positioning system can be further revealed. Use pictures and texts to illustrate language comprehension and knowledge expression:

Fig. 16. Big string formula: 知 + 识 = 知识

The big string formula seen in Figure 16: *知 + 识 = 知识*, this kind of expression can be seen everywhere in the system of Chinese characters and Chinese speeches, it seems not uncommon, but if it is used to interpret the semantic triangle revealed by Ogden and Richards from different angles: the most typical is Frege's sign, reference and meaning; Wittgenstein's language, thought and world; Saussure's sign , signifier and signified. Ogden and Richards expressed them as the famous semantic triangle in

"*The Meaning of Meaning*", and the theoretical fusion of intelligence further passes three sets of big string formulas: 文text + 法law = 文法grammar, 意+义=意义, 物+理=物理physics, and found a converging intellectual triangular pyramid model and information tetrahedron model that integrates the entire ideological development process of China and the West:

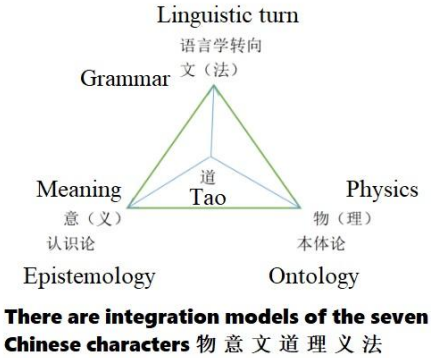

Fig. 17. Ancient Greek Philosophy, Modern Science and Contemporary Rongzhixue

As can be seen from Figure 17, there are integration models of seven Chinese character 物 意 文 道 理 义 法 . It uses micro-language/Yan/Chinese characters, combined with the three-dimensional coordinate system of the Tao function and three sets of functions: 物（理）,意（义）,文（法）as the macro-level top-level classification knowledge ontology.

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