

Research on the Formation of Chinese Characters

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Abstract

Alphabetical writing systems use letters that are closely related to speech to record speech. However, the glyphs of Chinese characters do not directly express sounds, and the ideographic mechanism between the glyphs and their meanings is not transparent. We analysed the relationship between the glyphs and meanings of nine thousand Chinese characters and found that the combination of elements in the glyph constructs certain imagery, and this imagery is a psychological representation of the experience informing the concept of the character, so the meaning and glyph of the characters are ideographically connected. In other words, the formation of Chinese characters is to use a small number of basic components with images to combine with each other to construct different imageries, so that the imagery can metaphor the meaning of the Chinese characters, including polysemy. In order to search for these imageries scientifically we propose four necessary conditions that the imageries sought must meet. We use the many related meanings derived from the configuration to infer the imagery of the configuration, so that this imagery can explain the meanings of the characters. In the end, we found out the imagery and structure these nine thousand Chinese characters, summarized the five combination modes of Chinese characters, and extended these combination modes to multi-character words combining characters and characters. These results reveal the ideographic mechanism of the hierarchical combination of the internal structure of Chinese characters and their imagery, unearth the interpretable imagery and knowledge that directly represent the meaning of Chinese characters, and help propose a guiding theory for character word formation in the Chinese writing system.

Keywords: Chinese Characters, Imagery, Ancient Culture, Morphology, Cognition

Introduction

According to the literature, the extant writing systems in the world today can be roughly divided into alphabetic writing systems and ideographic writing systems. The coding of alphabetic writing systems uses the correspondence between letters and pronunciation, that is, the "graphemes-phoneme correspondence rule" to combine letters to record speech, so that there is an obvious parent-child relationship between speech and text. However, there is no such direct correspondence between Chinese phonetics and glyphs because Chinese characters do not directly express phonetics, glyphs are not coded according to phonetics, and there is no parent-child relationship between spoken language and Chinese characters as in alphabetic writing. Therefore, can we say that Chinese characters are ideographic? At present, it cannot be said for certain. Since the time of Xu Shen (許慎), Chinese character scholars have generally accepted and used the concept of pictophonetic characters, and pictophonetic characters accounted for more than 80% of Chinese characters [1]. Under such circumstances, the research on the configuration of Chinese characters for the past two thousand years has always lacked clarity on phonograms and ideograms.

Since Chinese characters are an invention of mankind, the configuration of Chinese characters is by no means an arbitrary

code. It is necessary for us to conduct a new scientific investigation on the configuration of Chinese characters. First, we limit the research object to regular-script Chinese characters in order to research the synchronic plane because the diachronic change in glyphs involves the designer's cognition of their environment; otherwise, the configuration of the Chinese characters will not change. We cannot use intergenerational cognition to explain before and after. This phenomenon can only be explained by the phenomenon itself. This is a scientific requirement. Therefore, the Chinese characters referred to in this manuscript are all regular-script characters.

Second, the shape of the ideograms we understand is designed based completely on the meaning of the word. If the Chinese character is an ideographic character, its configuration should also be able to explain the meaning of the character. Here, we assume that Chinese characters are ideograms. Therefore, we decided not to consider the differences between the three components that form Chinese characters, namely, ideographic symbols, phonetic symbols and signs (symbols that are neither ideographic nor phonetic), which are generally considered in Chinese character textbooks. In other words, they are all regarded as ideographic symbols. In this way, we can fully explore the possibility that Chinese characters directly represent meaning.

Third, in linguistics, the concept of “words” is used in every form of language. In spoken Chinese, “words” include the smallest independent units of phonetics and semantics. However, within the Chinese writing system, the concept of “words” needs special explanation because the basic units of the Chinese writing system are “square characters” or Chinese characters. Since Chinese characters record both pronunciation and semantics, Chinese characters also have the connotation of “words”. In the Chinese writing system, the greatest difference between characters and words is that each word may contain one or more Chinese characters. The most troublesome result is that there is no distinguishing mark between words, such as the spaces between words found in alphabetic writing systems. Therefore, we call the words in the Chinese writing system character words, which include single-character words (words of single-character) and multi-character words (words of multi-characters combination).

Looking at history, after the publication of “Shuowen Jiezi” (說文解字) by Xu Shen in the Eastern Han Dynasty, a massive monument to Chinese characterology was erected, and no one has yet been able to surpass this monument [1]. However, the monument has been standing for nearly 2000 years, and Xu Shen’s theory of “six principles(六書)” cannot meet the modern requirements for scientific rigor. In the Song Dynasty, although there were some bright spots, such as Wang Anshi’s (1021-1086) “Zishuo” (王安石：字說) and the contemporary Wang Shengmei’s “Youwenshuo” (王聖美：右文說), these influential figures unfortunately did not systematically sort or empirically explore ideographic characters.

Modern research in the humanities, linguistics, cognitive linguistics, cognitive psychology, semiotics, linguistic semiotics, cultural semiotics, etc., has provided a theoretical grounding and vision for us to study the relationship between the shapes and meanings of Chinese characters. Today, we see Chinese characters not only as a language but also as a phenomenon of human social behaviour, culture, and collective psychological cognition. Therefore, we study Chinese characters from the three perspectives of language, cognition, and culture and the relationship among them. At a linguistic level, words are only a kind of symbol of material intermediary, behind which lies the concept produced by the mind's understanding of the world; these cognitive contents are a reflection of the experience of cultural knowledge and natural common sense.

Fundamental

When Cangjie (倉頡) invented writing, there was no writing at that time, but there was language. Language evolved naturally, but writing is an invention of human culture. In other words, there was already spoken conversation when writing was invented, and meaning can be expressed through spoken language. In order to invent characters, what Cangjie faced was what he had to encode the configuration based on so that these characters could represent the sound or meaning of the language. This is a question about the principles and methods of the configuration of Chinese characters.

Therefore, we naturally ask, what is the principle of the forma-

tion of Chinese characters? The Chinese characters we are still using so far use their meanings (including morphemes). Why do these glyphs represent their own meanings? Especially most Chinese characters are still ambiguous. This question is like finding the cause through the result, but it is a reinterpretation of a fait accompli.

In order to explore the principles of the formation of Chinese characters, we must understand that the core of this question is how to represent abstract concepts or meanings. Looking back at history, we know that no matter from the east or west, the source of human writing begins with painting, that is, to characterize things by tracing the appearance of external things. However, once deepened, this way of representation cannot represent abstract concepts and meanings. As a result, the Indo-European language family in the West had to turn to phonetics, that is, to express any concept or meaning by encoding speech in the form of alphabetic writing, thus avoiding the difficulty of representing abstract concepts or meanings. Because phonetics and meaning are two different categories, the corresponding meaning of phonetics can be established by convention. The arbitrariness of language and the Graphemes-phoneme correspondence rule are developed in this way. Of course, this was gradually realized after the Greeks invented vowel characters in the middle of the 4th century BC.

However, Oriental Chinese characters continue to stubbornly move towards ideographic meaning. How does it overcome the difficulty of image representation for complex and abstract things? In order to explore this question, let us return to history and culture and seek answers from Bagua(八卦) and Wang Bi(王弼 226-249 AD)'s “言意之辨”. Then, it is explained and understood by modern cognitive theory [2].

What is the relationship between Bagua or Zhouyi(周易) and Chinese characters? Yes, because Chinese characters are structured in the same way they are. In “易傳·系辭上”:
書不盡言，言不盡意。然則聖人之意其不可見乎？子曰：聖人立象以盡意，設卦以盡情偽，系辭焉以盡其言。

The saint (Confucius 孔子) clearly distinguishes between the four concepts of “writing, talking, imagery, and meaning”. Written words cannot fully express spoken language, nor can spoken language fully express meaning; however, the saint adopted the same method as that used to form the Bagua. That is, he used imagery to express meaning. Here, the key is how to understand “imagery(象)”. “Know imagery(明象)” is a special concept in the hermeneutics of Zhouyi. It refers to a complicated process in which the hexagrams and lines are understood in the Zhouyi. “系辭傳”:

“易者，象也；象也者，像也。” “八卦成列，象在其中。”

“Zhou Yi” is essentially a classic that attempts to apply the imagery symbol system to symbolize everything in the world. Regarding the origin of “imagery(象)”, “系辭傳” explains it like this:

“是故夫象，聖人有以見天下之賾，而擬諸其形容，象其物宜，是故謂之象。”

Therefore, “imagery(象)” constitutes the core of Zhou research.

If you don't "know imagery", you will not be able to understand Zhouyi. Kong Yingda speaks more bluntly about the necessity of "know imagery":

We look inside the Bagua. The Bagua is a three-layer combination of two types of lines, namely yin(陰) and yang(陽) lines, each of which corresponds to a phenomenon, and the hexagrams are the interpretations and judgments made by the saints on the meaning of these phenomena. Let's look at the symbol part, which is the yin and yang line of three different combinations. The ways of these symbols correspond to the glyphs of Chinese characters [3]. For example, Chinese characters are also composed of a small number of character elements, that is, a small number of fixed configuration elements (the element means that they cannot be divided). Bagua is a combination of three layers of Yin and Yang, so it can form eight different combinations, and 64 Gua(卦) is a six-layer combination, so 64 different combinations can be created. According to our research, Chinese characters have 84-character elements, and 84 Chinese charac-

ters can be combined with a six-layer combination. Let's look at the "imagery" part again. In Bagua, each hexagram name (乾、兌、離、震、巽、坎、坤) corresponds to a natural symbol, that is, an "imagery" (天、澤、火、雷、風、水、山、地). In contrast Chinese characters, the configuration of each Chinese character is the result of the combination of character elements, and the combination of character elements corresponds to the combination of imagery elements and may be a multi-level combination. Therefore, the configuration of each Chinese character is a construction of "imagery". In other words, such a configuration only constructs the "imagery" that characterizes the character, and there is a correspondence between the configuration and its "imagery". Finally, let's look at the part of hexagrams. The hexagrams are to explain the meaning of the imagery. Corresponding to Chinese characters, it is the meaning of the character. In this way, the relationship between hexagram images and hexagrams can correspond to the relationship between the image and meaning of Chinese characters. We make this correspondence between Bagua and Chinese characters into Table 1:

Table 1: Comparison of the Bagua and Chinese characters

Symbol	Element	Combination	Quantity	representation	imagery	Meaning
Bagua	Yao (2) (爻)	Gua (卦)	2 ³	Gua yao (卦爻)	Imagery of guayao	hexagram
character	Icon (84) (字素)	Glyph (字形)	87 ¹⁰	Glyph of char- acter	Imagery-glyph	Meaning of character

The question now is, why can "imagery" express "meaning"? According to the existing literature, before Wang Bi, no one had made a systematic analysis of the basic implication of Zhu-yin's views on speech and meanings. However, in "周易略例·明象", Wang Bi first generalized "speech" and "writing" as "speech", and proposed the famous "distinction between speech and their meaning(言意之辨)", which incisively pointed out the reproductive relationship of "speech, imagery, and meaning." Facilitated the leap of this question to linguistics:
夫象者，出意者也。言者，明象者也。盡意莫若象，盡象莫若言。言生於象，固可尋言以觀象；象生於意，固可尋象以觀意。意以象盡，象以言著。

This passage from Wang Bi clearly shows that the function of writing is to construct "imagery". After the "imagery" are obtained, they can be used to understand the "meaning". This passage qualitatively clarifies the progressive relationship among the three "writing, imagery, and meaning". Wang Bi's passage is important because in it, he explains the problem of representing abstract concepts because they are the result of generalization from concrete phenomena. Therefore, abstract concepts can be understood by extracting "imagery". There is a connection between abstract concepts and their "imagery". This relationship between imagery and meaning is the basis for the formation of Chinese characters. For example, the character "象"(elephant), from the structural point of view, it is composed of the head of "兔(rabbit)" and "豕(pig)" up and down. The "imagery" they constitute is "a fat animal like a rabbit head and a pig body." This imagery in addition to emphasizing the appearance, the imagery also directly uses metaphors. Therefore, the configuration of the character "象" describes the imagery of the character " ". After

clarifying the imagery of the character "象", it also completes the meaning and representation of the character "象" at the same time: meaning This is the meaning of the character "象". It has the meaning of elephant (animal) and metaphors such as "象". The representation is the configuration of the character "象". Therefore, the relationship between "imagery" and "meaning" is essentially a metaphorical relationship.

From a modern perspective, Wang Bi's "言意之辨" solves the problem of meaning and representation of Chinese characters, although Wang Bi is a "fusion of horizons" based on Confucian "周易·系辭". If we use modern cognitive theory to look at the relationship between configuration and meaning of Chinese characters, it will be more scientific. But Wang Bi may be the first discourse in Chinese traditional culture that systematically discusses signification and representation .

If we explore the relationship between the configuration and meaning of Chinese characters from the perspective of modern cognition, we will ask: How is the concept or meaning of people formed? We know that cognitive linguistics studies the formation of the human body's experience with the human conceptual system and reasoning is a core component. Edmund Gustav Albrecht Husserl said that primitive movements are the ancestor of all cognition. Cognition is the result of highly complex interactions among the body, brain, and environment. Many psychological experiments have established that language understanding is closely related to physical behaviour. The famous neuroscientist and Nobel Laureate Gerald M. Edelman said, "The idea of thinking of meaning as an abstract symbol is one of the biggest fallacies in the history of science." This experience-based cognitive

theory gives the concept of meaning a grounded foundation. At the same time, the evolution of the human brain makes it possible to perform high-level simulations of various actions of the human body, as well as the relative position of the human body in space, society, and other contexts. One of the results of this continuous evolution of cognitive stimulation is the formation of human consciousness, and language plays an important role in supporting this continuous evolution of simulation. Wilson once concluded that cognition is produced by action, and memory can be developed to transform the actual interaction experience of the external world into a form that can be interpreted by the brain. These off-site situational cognitive activities are based on concepts related to the body's perception of movement, and many pieces of evidence show that we often perform off-site and non-real-time simulations of external situations. For example, "mental imagery" is a psychological simulation of external event operation. Embodied thinking may be the essence of human thinking. From the perspective of cognitive psychology, cognition is generated by the human nervous system and various perceptual senses; it then enters the conscious, encodes information and transfers it to memory, whence it is represented and organized in one's emotions to form knowledge. Thus, it goes on a journey from experience to knowledge. Therefore, the formation of a concept or meaning originates from the cognitive processes of sensing, perceiving, and experiencing.

In the formation of meanings and concepts, there are two issues that require attention: one is how these meanings or concepts are represented in our emotions. The other is how these meanings or concepts extend from direct experience to complex abstraction to the entire conceptual system. Regarding the first issue, cognitive psychologists generally agree that there are three ways knowledge is encoded and represented, that is, imagery, language (or other symbols), and propositions. Writing symbols were created in the era of Cangjie. Therefore, the coding form for representing knowledge was mainly imagery and propositions, with the latter being the product of the very developed and advanced logic.

Importantly, Shepard (1971) and other researchers put forward the hypothesis of functional equivalence in regard to the external representation of imagery, such as images and photos in books, and the internal mental representation that we care about, that is, mental imagery. This hypothesis argues that the representational form of imagery and the perceptual experience triggered by visual stimuli are functionally equivalent, even if the two (images and imagery) are not truly equal. Imagery is a specialized concept of cognitive psychology. It has been widely used in the fields of literature and art. It is a phenomenon of the conscious. It is an external scene that is recreated in the brain. It is different from objective existence. It is an imaginary experience that comes after subjective observation, and it is a combination of the subjective and objective.

Regarding the second issue, that is, how meanings or concepts extend from direct experience to complex abstraction to the entire conceptual system, the "conceptual metaphor theory" of cognitive linguistics provides a good explanation. George Lakoff and Mark Johnson said in "Metaphors We Live By" that

the system of daily concepts is essentially metaphorical. They analysed embodied metaphors, from directly emerging concepts to metaphorically emerging concepts. They emphasized that the main function of a metaphor is to facilitate understanding and conceiving of one thing from the knowledge of other things. This metaphor of familiar things versus more abstract and complex things is the main way in which meanings or concepts are deepened and expanded, eventually accumulating to form a cognitive system; in other words, it is achieved from direct emergent concepts and metaphorical emergent concepts.

At this point, we return to the question of how Cangjie encoded characters. When Cangjie wanted to encode a known meaning or concept, he would ask where the concept or meaning to be encoded came from. He sought to return to the formation of the meaning or concept, that is, to the source of the experience established by the meaning or concept or the scene of the empirical situation where an event occurred; in such a way, the imagery of the situation would appear in his mind. Therefore, he needed to code according to this imagery because it could represent the target concept or meaning. This was the main way he encoded the meaning or concept (knowledge). For example, if he wanted to represent the concept of a "tree", he could draw a simple tree shape (木). If he wanted to represent the concept of a "person", he would draw the shape of a person walking sideways (人), and so on. These are the so-called direct emergence concepts. Therefore, to understand the configurational rationale of Chinese characters, the key is to determine the configurational imagery of the character. This configurational imagery relates to the meaning or concept of the character and, at the same time, is connected with the context of the subconscious experience. The imagery is essentially metaphorical or analogical. Therefore, the ideographic meaning of Chinese characters mainly helps complete the coding configuration through the mental representation of environmental cognition, that is, through imagery.

However, a limited number of simple things can be traced directly. How can more abstract and complex concepts be represented? For example, how can the concept of "more" be represented? Although "more" does not itself indicate a specific thing, it is applied to specific things. As a result, Cangjie seized upon the common imagery of concrete things that could represent the concept of "many": everything in the world is dark at night except the sky, which is full of stars. Therefore, the image of the night sky full of stars can represent the concept of "more" through metaphor. As a result, the concept of "moon" (月) emerges directly from this process. The slightly different form of this character, meaning "evening" (夕), conveys a slightly different concept, the light moon, meaning the twilight period; furthermore, an overlapping combination of two "evenings" (夕+夕) can represent aggravation. The light moon comes late at night. Thus, the character "多" is formed.

It can be seen from this that the development of Chinese characters can be divided into two stages: the first stage is when a small number of directly ideographic characters, that is, iconic characters, appeared. They are the result of directly mimicking the shape of specific objects, and they are directly emerging concepts. However, while there are few iconic signs that can be

directly described, they can be used as imagery features, and the combination of several such features, especially combinations that comply with the cognitive principle, can represent more complex and abstract imagery. In other words, complexity can be represented by simple combinations, and complex conceptual imagery can be represented by combinations of simple imagery based on cognitive principles. As a result, the combination of a few iconic signs produces imagery features that form Chinese characters; thus, Chinese characters can continue to be extended and expanded. This is the second stage of Chinese character formation. As metaphorical concepts emerge in the second stage, they use iconic signs to generate imagery features. Under the guidance of the cognitive model, the relevant imagery features are combined to produce the imagery that gives Chinese characters meaning. This meaning is embedded in the shape of the character; that is, hierarchical components are combined with a few icons and are then formed into the glyphs that constitute Chinese characters. We consider this combination of characters and into multi-character words the third stage. Therefore, this combination process greatly improves the efficiency of symbols and can significantly affect the use and clarity of Chinese characters.

In fact, the ancient Han people called the few iconic symbols of this "direct emergence-type concept" "文", and called the "metaphorical emergence-type concept" that is a hierarchical combination of "文" as "字." In the West, Aristotle, who was more than five hundred years ago Wang Bi, put forward the theory of knowledge sources. Aristotle believed that there are four modes through which people understand external things: 1. Origin, 2. material composition, 3. distinguishing characteristics, and 4. purpose or function. His subjective classification based

on recognition demonstrates the process of knowledge systematization. The relationship between knowledge and its source, or the relationship between an abstract concept and its source, is precisely the relationship between "meaning" and "imagery". In philosophy, this relationship is drawn between reason and sensibility. Therefore, the imagery of Chinese characters captures the visible imagery of the source of the meaning and follows this source to capture the concept's invisible meaning. If this perceivable source is sufficiently indicated, people's common experience can help them understand the intended abstract concept. Therefore, any cognitive experience, including common sense and knowledge of human-made cultural phenomena and natural phenomena, can be projected onto the content of the imagery. According to Zhou Yamin's (周亞民) and Huang Churen's (黃居仁) research on ideographic symbols in Chinese characters, the Chinese character families derived from each ideographic symbol form a small knowledge system, and this system is based on salience and relevance to human cognition. They found that such knowledge systems conform to the empirical framework of knowledge sources proposed by Aristotle. The cases they studied show that Chinese characters have a strong knowledge expression system that directly represents the cognitive model of human beings.

The above describes the basic principle of the formation of Chinese characters: a hierarchical combination of a few imagery elements to construct an imagery that can represent the meaning of the character. Therefore, we call this character formation method the "character formation based on imagery" method. Figure 1 is a schematic diagram of this hypothesized principle with imagery at its core.

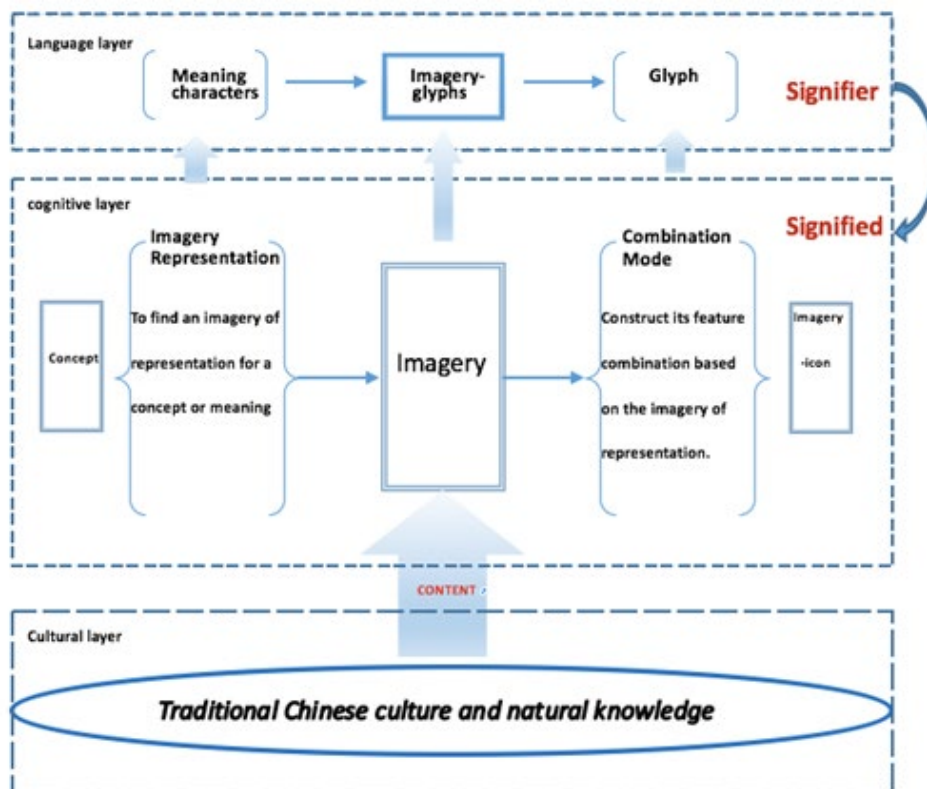


Figure 1: The basic principles of character formation

structure and combination

We selected nine thousand Chinese characters, disassembled and analysed them, and found that they had a hierarchical combination structure. They are formed through a process of hierarchically constructing imagery, and this imagery is a psychological representation of the experience situation that gives rise to the concept conveyed by the character. In other words, Chinese characters achieve their ideographic purpose through the empirical imagery related to the concept they depict. Therefore, three major tasks of “character formation based on imagery” theory are: 1. Describe the internal structure of Chinese characters; 2. Find out the cognitive model of the internal combination of Chinese characters; 3. Use the existing meanings to reversely dig out the structure of these nine thousand Chinese characters from the Chinese character to the character word system and the imagery of the load.

Terminology and structure

Since we introduced the concept of "imagery" to the formation of Chinese characters, our views on the formation of Chinese characters have undergone a fundamental change, that is, the formation of Chinese characters has been regarded as the carrier and representation of its imagery service. As a result, the

past concepts such as strokes and parts are no longer suitable for describing configuration, because they lack the soul of imagery. Therefore, we will naturally ask for any configuration: what is its imagery in such a configuration, so that the imagery becomes the distinction and combination mark between the configurations. Different "imagery" means different configurations, and the configuration and its imagery become an inseparable dual relationship between the signifier and the signified. This is the essence of the so-called double-track configuration inside Chinese characters.

Using the results of our dismantling and analysis of nine thousand Chinese characters, we propose a dual-track configuration with the three hierarchical structures of the upper, middle, and lower levels of Chinese characters. The glyph (signifier) is divided into three hierarchical levels: upper, middle, and lower portions that correspond with the "glyph, component, and icon". In terms of imagery (signified), these upper, middle and lower portions form the "imagery glyph, imagery component, and imagery icon". As a result, Chinese characters present a vertical three-level structure and a horizontal dual-track correspondence. Figure 2 and Table 2 are schematic diagram of this three-level dual-track structure.



Figure 2: Three-level, dual-track structure.

Table 2: Three-level, dual-track structure

3 LEVEL	CONFIGURATION	IMAGERY
I	字形 glyph	字意 imagery glyph
II	構件 component	構意 imagery component
III	字素 icon	意素 imagery icon

The glyph is the shape of the Chinese character, which is a kind of writing stroke based on specific material formed by square written characters. The glyph corresponds to an imagery glyph, which is the imagery formed by Chinese characters. The glyph is also a signifier, and the imagery glyph is what is signified in the upper level of the character; thus, the glyph carries the imagery glyph in the body of the character. A glyph contains the imagery glyph, which indicates the purpose of the Chinese character because only imagery glyphs can explain the intended meaning, and imagery glyphs bridge the glyph and its meaning. If a glyph has any function, then its only function is to represent the imagery glyph. Therefore, the glyph and the imagery glyph are two inseparable aspects of a mental concept.

It should be noted that imagery glyphs and the meaning of Chi-

nese characters are two completely different concepts. The former is the empirical imagery associated with the meaning of the character and is the basis for construction of the glyph; the latter has morphological meaning or is a morpheme. Glyphs and imagery glyphs are philological concepts, and the meaning of a character is a linguistic concept. Imagery glyphs appear in Chinese characters, and the meaning of the characters is used to determine the syntax of the written language. Therefore, the imagery glyph is the mechanism by which the configuration of Chinese characters can be expressed.

The glyph and the meaning of the characters are linguistic phenomena in Chinese writing and also part of objective reality, which we can look up in the dictionary. We cannot create phenomena, but we can understand and describe them. Imagery

glyphs are originally imageries describing the relationship between glyphs and the meaning of characters, but they are lost after the meaning is standardized because they are not directly used in written language. Once the automatic connection between the glyph and the meaning of the character is established in human consciousness, the meaning of the character becomes “cumbersome” and is lost. Today, when we study the relationship between glyphs and meanings, we inevitably find the “bridge” that connects them, that is, the imagery glyph.

The writing that is handed down in the world is constructed through combining elements; that is, a few elements are combined with each other, sometimes forming multi-level combinations. Chinese characters are no exception. Most Chinese characters are composed of internal components, which is not difficult to see. In fact, traditional Chinese character studies also recognize this and call this limited element “文”; the characters formed by the combination of “文” are called “字”. Therefore, this combination has inevitably come to form a character word system that includes the configuration system and its imagery system. Thus, the glyph is the result of the combination found in the lower layer, and the imagery glyph is the result of the combination of imagery in the lower layer. In this way, there must, logically, be some basic elements in the whole system, and the whole character word system is the result of the continuous multi-layer combination of these basic elements.

The so-called basic elements are elements that cannot be divided. For Chinese characters, the basic element is that the configuration that disagrees with the imagery or the configuration with the smallest imagery can no longer be separated. We call these basic elements as icons. The imagery of icons are the small-

est imageries, and these smallest imageries are called imagery icons. Therefore, the icon corresponds to the imagery icon; the icon is the signifier, and the imagery icon is the signified, thus forming the lower level or element level. The icon carries the imagery icon; the icon is the carrier, and the imagery icon is the body. Icons are iconic symbols or pictographic characters. Similarly, imagery icons are directly emerging concepts that describe shapes, such as “人, 木, 日, 月”. These few icons and their imagery icons are hierarchically combined like Lego blocks to construct the entire character word system.

The component is an intermediate part with its own imagery that does not include the icon and the glyph. It characterizes its own imagery, that is, the imagery of the component. This imagery is called the imagery component. The component corresponds to the imagery component; the component is the signifier, and the imagery component is the signified, thus forming the middle level or the structure level. A component is a combination of icons or other components. It can be created through the combination of multiple levels until it forms a glyph. Similarly, an imagery component is a combination of imagery icons or other imagery components. The imagery component can be created through the combination of multiple levels until it forms an imagery glyph. Between icons and glyphs, there may be many combinations, and each of these is called a level or plane. Each level or combined plane is called a glyph byte. The corresponding combined imagery component is called an imagery byte. Some of the icons are Chinese characters, and most of the components are also Chinese characters. In other words, a Chinese character can be an icon or component of other Chinese characters. For example, the structure of the character “構” is shown in Figure 3.

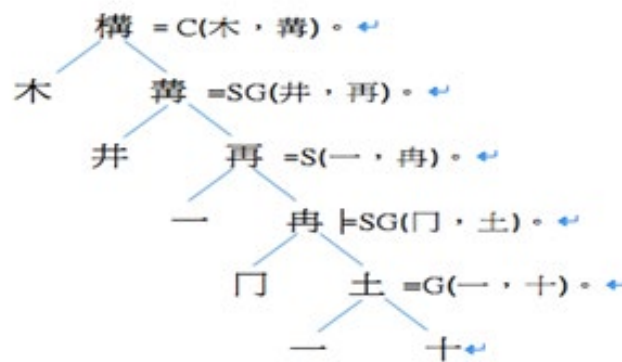


Figure 3: The structure of the character “構”

The character “構” uses only five icons (十, 一, 冂, 井, 木) and its imagery icon. From the combination of these five layers, five glyph bytes (土, 冉, 冉, 耑, 構) and the character “構” are formed. Here, in addition to “構” and icons, there are components. The imagery glyph of “構” is “such as the wooden pole truss above the wellhead.” This character uses the contextual imagery of digging a well to metaphorically represent the meaning of the character “構”, and it also includes ambiguity. Of course, this imagery is very clear to one who is familiar with the traditional work of digging. Each glyph byte corresponds to its imagery bytes, and the imagery glyph is constructed by stacking layers of imagery bytes according to a certain combination model.

It can be seen from this that the icon can be added layer by layer through this hierarchical combination; that is, the icon can appear on different levels. Similarly, imagery icons can be added layer by layer and may appear at different levels. Each combination forms glyph bytes and imagery bytes. Therefore, the imagery glyph realizes the multi-layer combination of the imagery bytes through the multi-layer combination of glyph bytes and, ultimately, completes the construction of the imagery glyph. Therefore, the so-called creation of a character is a new imagery that constructs the meaning of a new character, and the new character configuration reflects this new imagery.

Here, we can also see that the glyph, component, and icon of the

character are dominant; that is, these elements can be observed, while the imagery glyph, imagery component, and imagery icon of the character are hidden and merely exist in our brains. One of the tasks of this work is to uncover these hidden elements

scientifically. Thus, we have made a rough comparison between the alphabet writing system and the Chinese writing system, as shown in Table 3:

Table 3: Comparison of the alphabet writing system and the Chinese writing system.

Chinese writing	icon	imagery icon	imagery bytes	imagery glyph	meaning of the character	character word
Alphabet writing	alphabet	phoneme	syllable	Morpheme pronunciation	morpheme	word

We are curious how these very limited imagery icons can be combined to form a variety of different imagery glyphs. This combinatorial model issue is discussed below. Complex and diverse imagery can be constructed through the combination model.

Combination models

The configuration of Chinese characters is composed of the combination of the icons, and its purpose is to construct the imagery glyphs. But how are two (or more) imagery icons or imagery components combined in any plane? That is, what is the relationship between the new imagery after the combination and the imagery of the members of the combination? Why can they be combined to construct a new imagery? And what is the mechanism of their combination? Our research has found that the ancient Han people used different imagery to combine and construct new imagery, which is represented by the combination of icons or components to form new components or glyphs. For example, "土" is a combination of "一" and "十". Both "一" and "十" are icons. Why is the concept of "土" combined with "一" and "十"? It turns out that the imagery of "一" is "the world in which Pangu (盘古) is still in the egg", which is the initial state of the universe without distinction. Here the "一" is below, and it generally represents the earth. the imagery icon of "十" is "after Pangu's death, his body transformed into all things and formed a complete earth", so these two separate imageries jointly construct the imagery glyph of "土", which can also be translated as "a large portion of Pangu's body transformed matter on the surface." Here, we are most concerned with the relationship between "一" and "十" and what the rationale for combining is. After much research on imagery glyphs, we identified five combination models, namely, the conceptual model, metaphor model, gestalt model, schematic script model, and declension model. The first four models are cognitive models, as they are based on cognitive principles, while the last corresponds to the principle of glyph transformation. These five combination models comprise the ideographic mechanism of Chinese characters. Through this mechanism, the imagery glyph of Chinese characters is constructed to represent the meaning of the characters. This theory of Chinese character ideology is called the "character formation based on imagery" hypothesis.

Conceptual model

Humans interact with the environment to generate cognition. Language is a simulation of this kind of cognition. It conveys concepts by recreating a sensory experience. This kind of cognition first involves the classification of the world; a general idea or a category is used to describe concept, and a character word is the symbolic written name or label for that concept. A concept

is a basic unit of symbolic knowledge, and it is a tool for understanding the world. For example, the phrase "the birth of the world" symbolizes the event of human beings becoming distinguished from the chaos of indiscriminateness; various categories have since emerged, thus forming a world with distinct species. From this perspective, the evolution of civilization is the evolution of a classification system. Humans organize many concepts through classification. A category is a hierarchy of concepts, and it includes various members, so the concept is a hierarchical structural system. Both the conceptual system and the character word system have the same hierarchical structure. Humans use this classification to understand their experiences.

There are many theories about classification and concepts, and in modern times, many of these have developed into prototype theories. The key component of a prototype is its most characteristic attribute. When we explored imagery glyphs and imagery components, we found that the ancients mastered the essence of classification and concepts. When two imagery types are combined to construct new imagery, there are many combination models for conceptual relationships, such as [category + feature]. Therefore, we call this model a conceptual model. For example, the characters "桃, 柚, 梅, 棠, 梨, 楓" are generally called pictophonetic characters in Chinese character textbooks. In these characters, "兆, 由, 每, 尚, 利, 風" are phonetic symbols, and they are used to distinguish the names of various fruit trees. We are not opposed to this interpretation, but we are more concerned with the interpretation of the meaning of characters, although the pictophonetic characters also represent "trees" here. Let us look at the character "桃". In our research, the imagery glyph of "兆" is "burning oracle bones for divination, cracks like splashes of water." The character is derived from the practice of divination and includes the imagery for "symptom". Therefore, the imagery glyph of "桃" is "fruit trees that bring signs of spring", in which "木" is the category and "兆" is the characteristic. This interpretation can be confirmed by many literary works in Chinese culture, where peach blossoms are used to symbolize love between men and women because they herald the arrival of spring. Another example is the character "楓"; maple(楓) leaves turn red instead of yellow as usual, which is a prominent feature of maple trees; and "風" is the cause of maple leaves turning red. Thus, "風" became the characteristic of maple leaves turning red, and indirectly became the characteristic of maple trees. This example conforms to one of the four models of knowledge sources proposed by Aristotle. As for why the pronunciation of "楓" and "風" are the same or similar, that is, why the pronunciation of some pictophonetic characters and their phonetic symbols are similar or the same; our explanation for this phenomenon is that this may be because the phonetic symbols are also Chinese characters, and

the Chinese characters are pronounced according to the local dialect, which causes the phenomenon that some pictophonetic characters are the same or similar to their phonetic sounds, but this is only an epiphenomena. Here, the interpretation of phonetic and ideographic can be mutually inclusive, they are not mutually exclusive, because they belong to different categories.

If the propositional representation is used, the conceptual model should be:

Chinese character = C (category, feature)

Here, C is a conceptual model, which means that there is a conceptual relationship between categories and features. Therefore, the propositional representation of "桃" can be written as: 桃 = C (木, 兆)

Metaphorical model

Language is the process of reconstructing a sensory experience, and the world as depicted through in language is a conceptual world that has been reorganized and interpreted. This process of experience reconstruction is metaphorical. In ancient China, it was common to use metaphors in literary works, such as "The Book of Songs". However, since George Lakoff & Mark Johnson proposed the conceptual metaphor theory, we have become aware that metaphors are based on cognition and are thus everywhere. The conceptual metaphor theory assumes that metaphors are a cognitive phenomenon; they appear in language, and they have a cognitive basis. The conceptual metaphor connects two conceptual domains: the source domain and the target domain. A conceptual domain is a collection of semantically related essences, characteristics, and functions. The source domain usually consists of concrete concepts, such as cash, while the target domain involves abstract concepts, such as time. The conceptual metaphor theory assumes that we use the source domain to understand the target domain. For example, when we say, "time is money", we use money as the source domain to explain time. Similarly, when we talk about time or money by saying "flower time or flower money" (花時間, 花錢), it is because we understand that a "flower" is a phenomenon marked by rapid decay. Therefore, we use "flower" as the source domain for "quickly spent" to illustrate the target domain of the rapid loss of time or money. Here, "flower" changes from a noun to a verb to describe the dynamic of being "flowerlike".

There are many studies on metaphorical theory, including on the reasoning behind using source domains and target domains and on the relationship between the two. However, the metaphorical relationship between the source domain and the target domain exists in the combination of two in Chinese characters to construct new imagery. We call this metaphorical model of [target domain + source domain] the composition of imagery glyphs or imagery components. For example, in the characters "坡" and "咚", "皮" and "冬" are used as the source domain to metaphorize the two target domains of "土" and "口", with the resulting imagery glyph that the ground () is like skin and the sound (口) is like winter hitting ice. Of course, the metaphor here is also used as a feature, combining with "土" and "口" in a conceptual model. This combination of multiple models is called a compound model. If propositional representation is used, this metaphorical model can be expressed as:

Chinese characters = M (target domain, source domain)

Here, M is a metaphorical model, which means that there is a metaphorical relationship between the target domain and the source domain. Therefore, the propositional representation of the character "坡" and "咚" can be written as:

坡 = CM (土, 皮)

咚 = CM (口, 冬)

The imagery glyph is the imagery of Chinese characters, and its function is to metaphorically map the meaning of the Chinese character. In other words, familiar imagery is used to metaphorize the abstract and universal meaning of the characters. For example, in the character "權", the literal imagery glyph (imagery) depicts a bird's nest in a tree in the wild. Approaching the bird's nest will cause one to be overwhelmed by one's biological instincts. Therefore, this metaphor can represent concepts such as power and measurement. Similarly, the character "歡" indicates the mother bird returning to the nest and the young birds each opening their mouths to greet her, which is a metaphor for the mood the birds are experiencing at the moment. A bird's nest imagery component (glyph) from "窩" can be combined into the imagery glyphs such as "灌", "權", "歡", "罐", "觀", "驩", "勸", "鵲", "鸛", "矚", "謹", "鑪", "矚", "犴", "權" and "燿". The character's utility and efficiency are evident.

Gestalt model

Gestalt theory was developed in Germany in the early 20th century. The main argument behind gestalt psychology is that the whole is greater than the sum of its parts. That is, the best way to understand a psychological phenomenon is to see it as an organized and structured whole. According to this view, much linguistic information is incomplete, and this information needs to be filled in by human's innate gestalt ability. When humans observe and perceive the objective world, they always involuntarily allow their subjective experience to inform their understanding, linking the characteristics of seemingly unrelated things to achieve a grasp of the overall object. Similarly, human beings do not passively accept language. Readers will unconsciously assign their own experience to words, organize the relationship between words and sentences in their own way, and grasp the connotation of the work's semantics as a whole. Gestalt psychology also believes that the various images stored in the brain in the form of information are mental images produced from observation and reading. The function of such images is to improve the person's ability to make discoveries. As a product of the imagination, this process requires the storage of mental images. It cannot arise out of thin air. The theory of "character formation based on imagery" we put forward also uses the gestalt principle to conduct a comprehensive investigation at the three levels of language, cognition, and culture. In other words, we start with human cognitive instincts and cognitive rules to understand the formation of a character's meaning and its structural imagery representation as a result of the interaction between humans and the external world; finally, we consider the cultural background to integrate these components into a whole concept. Gestalt theory is one of the ideographic mechanisms of Chinese character formation.

Even though the integrity of this kind of gestalt effect is limited to the composition of the imagery glyph, a considerable number

of Chinese characters are combined using the principle of gestalt cognition. That is, two or more imagery components or imagery icons together represent the overall imagery of something. The basic model is [feature + feature]; therefore, we call this model the gestalt model.

For example, the character "火" is a combination of "人" and "灬". Its imagery glyph is "light and flames that make people sweat profusely." Here, "人" (people) and "灬" (sweat) are both features, and together, they point to the unstructured shape of an alternative thing, namely, the concept of fire. Another example is "囿", which is a non-character component; its imagery component is a square upper portion with a symmetrical container (囿) containing millet and other ancient grains below. It is composed of "一", "口", and "田", all of which are characteristics of "囿": "一" signifies a symmetrical lid, "口" signifies the opening of the container, and "田" signifies the food in the container. Another example is the character "爲", which is a combination of "爪", "尸", "尸", "尸", and "勹", in which "爪" represents a claw, "尸" represents a body, "勹" represents the handle of a hand-held object, and "勹" represents dynamic movement. They are combined into a single character that represents the imagery glyph of "two monkeys picking lice off each other". "爪", "尸", "尸", "尸", and "勹" are the constructive features.

If you use the propositional representation, this gestalt model can be represented as:

Chinese character = G (feature, feature)

Here, G is the gestalt model, which means that there is a gestalt relationship between features. Therefore, the propositional representations of the two characters "火" and "爲" can be written as:

火 = G (人, 灬)
爲 = G (爪, 尸, 尸, 尸, 勹)

The conceptual model and the gestalt model both have image features, but what is the difference between the two? The imagery glyph in the conceptual model is the same as its components. However, the imagery glyph in the gestalt model has no categorical relationship with its components; instead, there are characteristic relationships. For example, the concept of "身" has no categorical relationship with the components "自" and "才". "楓" and "木" are similar.

Schematic script model

Cognitive psychologists discovered that schemes are a representational method useful for studying how the human mind organizes concepts to form knowledge. We should consider the other information contained in a given concept, especially by thinking about the relationship between that concept and others and the relationship between the attributes of the concept. We may thus gain a better understanding of the meaning extracted from the concept. Therefore, schemas are a mental structure used to organize knowledge, creating a meaningful structure organized into different concepts. For example, the schemas that characterize decline in traditional Chinese culture relate to scenery such as dusk, autumn, and the West. Schemas are higher-level cognitive mechanisms than prototypes. They involve a wider range of aspects and contain more depth, involving concepts such as language, physical perception, and literary memory. Schemas are like a kind of background knowledge and are prone to stereotypes.

reotypes.

A script is a specific kind of schema that contains information about events occurring in a specific order. The script contains pre-set values for the expected actors, scenes, and sequence of events. These pre-set values are combined to form an overview of the event.

The reason we introduce the knowledge representation of schemas and scripts here is because the imagery glyphs of many Chinese characters reflect specific historical events or cultural situations. For example, the imagery glyph of "知" is "to understand the military message conveyed by Maodun's (冒頓) vocal arrows." This references a Mongolian named Maodun who invented an arrow that makes a sound as it travels through the air. He used this arrow to command his cavalry, as they would understand the information transmitted by the sound the arrow made. There are also many imagery glyphs that describe operations. They are all presented in schemas or script structures related to actions and backgrounds. As another example, the two characters "我" and "找" are mainly composed of "扌" and "戈". How does "手" holding "戈" represent the imagery glyph of "我" and "找"? This requires a return to the ancient battlefield in the cold weapon era when two armies fought each other in chaos. Currently, we cannot experience what the mood is like in a face-to-face melee on an ancient battlefield, but we are familiar with the feeling of distinguishing one group from another, for example, on the football field or basketball court, where distinguishing clothing in worn to mark the two sides. Similarly, distinguishing military uniforms were worn on the ancient battlefields. This marker indicates that the bearer should be "skipped". Therefore, if two opponents share the same marker, they are on the "我" side; otherwise, the battle will continue (找).

We call this kind of action image using background knowledge the schematic script model. If propositional representation is used, this schematic script model can be expressed as:

Chinese character = S (action, background)

Here, S is the schema script model, which means that the relationship between the action and the background is the schema. Therefore, the propositional representation of "知," "我," and "找" can be written as:

知 = S (口, 矢)
我 = S (扌, 丿)
找 = S (扌, 戈)

Declension model

The declension of Chinese characters refers to the non-combination of various Chinese characters, that is, when the form of Chinese characters changes and results in a direct change to the original imagery. The first four combination models are composed of two or more components and their imagery components to construct new imagery. These imagery components are combined with the components from the imagery icon layer by layer until the imagery glyph is completed. The combination of Chinese characters refers to the combination of more than one configuration in a certain plane space. However, the declension model involves a change to the shape of a single glyph or component to achieve a change in the imagery glyph or imagery

ery component. For example, the character "才" is formed by excluding the right hand of "木", thus signifying that a tree has become usable for construction after the branches are removed, and the wood is cured. Another example is the character "夂", which is formed by excluding one vertical line on the left from the character "夂". The imagery glyph of "夂" means that an adult is whole inside, while the incomplete "夂" indicates incompleteness and gaps. These examples all use physical alterations to change the final imagery. Therefore, we call this phenomenon the declension of the Chinese character configuration. Imagery components or imagery glyphs generated in this way follow the declension model.

If propositional representation is used, this declension model can be represented as:

Chinese character = D (component, deformation)

Here, D is the declension model, which means that between the component and the deformation is the declension relationship. Therefore, the propositional representation of "才" can be written as:

才 = D (木, - 丿)

Additionally, because there are seven forms of declension, the declension symbol must be added before the declension component in propositional representation. According to our empirical research, there are few declensions Chinese characters (less than one hundred), but they still play an important interpretive role in the production of imagery glyphs.

The above five combination models, including their compound modes, occur in each combination plane. The configuration of Chinese characters first requires the combination of icons and then the combination of components; finally, the glyphs of the character are produced. The creation of each new character and its imagery is constructed by combining existing shapes and imagery according to the combination model. In this way, new words continue to appear.

However, the internal space of Chinese character boxes is limited, the number of characters is constantly increasing, and the internal structure of some Chinese characters is unbearably swollen, which makes both writing and remembering difficult. Therefore, further ways to combine Chinese characters are being developed; that is, the development of single-character words into multi-character words. In this way, the number of characters written, created, and read can be somewhat controlled. The formation of characters and words follows a similar route, and the combination mechanism is the same. Modern words are integrated into existing concepts conveyed by Chinese characters and then unified. However, the combination of characters in a multi-character word is not a combination of imagery glyphs. It is a combination of the meanings of Chinese characters, and the relationship of these characters still utilize the four combination models (with the exception of the declension model). Multi-character words may be simple or complex, but we can still predict the meaning of the character word from the meaning of the Chinese character. For example, "車頭," "車頂," "車窗," "車門," "車椅," "車燈," "車尾," "車體," and "車胎" are still conceptual models. "火箭" is a gestalt and metaphor model. "革命" is a schemas model. "字詞" is the gestalt model.

For binding words (連綿詞), such as 葡萄, 蜻蜓, 蝌蚪, and 蚯蚓, although no single character carries the full meaning of the word, each character contains an imagery glyph because the characters have a configuration and must have an imagery glyph or imagery component. In short, when a Chinese character completes a configuration and forms an imagery glyph, it has an ideographic connection with the meaning of the Chinese character; after the imagery glyph completes its mission, the imagery glyph can be withdrawn from the written language. Therefore, the smallest unit of meaning in written sentences can only be a character word; that is, the meaning of a written language can only be constructed by combining the meanings of character words.

Norms, methods and results

The foregoing are all theoretical hypotheses about "character formation based on imagery". These are not so much theories as they are a description of the actual phenomenon of writing, because the glyphs, meanings and sounds of Chinese characters have already been established and are in use all the time. We cannot change them. We are just explaining the relationship between the glyphs and meanings of Chinese characters, but this kind of explanation needs to be implemented in each Chinese character. Therefore, one of our tasks is to find out and distinguish those unknown imageries and the configurations that carry them according to methods, so that Chinese characters and the whole character word system become real ideograms.

Norms

We know that the glyph carries the imagery, and the imagery determines the style of the glyph. After clarifying the task of exploring images, we must also establish some scientific norms for exploring images. It is impossible to guess imagery glyphs, imagery components, and imagery icons. Thus, we should set identification standards or norms for exploring these images. Therefore, to comply with scientific norms, we formulated four necessary conditions or principles that cannot be violated when speculating about imageries. They are the principles of consistency, objective configuration, interpretability and Chinese cultural common sense. Without these principles, the entire character system could not be established.

Consistency

The principle of consistency means that a certain imagery icon, imagery component or imagery glyph must have the same imagery across the entire Chinese character system. Because the system is the result of the repeated combination of icons, including their combined components, each imagery icon and imagery component must be consistent in its imagery regardless of how many times it is repeated; that is, the imagery should be stable. In other words, an imagery component, viewed horizontally, should maintain consistent imagery with other Chinese characters containing the component. Within a Chinese character, that imagery component should also maintain the same imagery as components on the upper level that are organized in the same plane. However, the imagery component comes from the combination of imagery components or imagery icons at the lower level. In this way, an imagery component maintains consistent imagery with the upper, lower, in-plane and other Chinese

characters and ultimately contributes to the imagery glyph as it relates to the meaning of the character. From the symbolic perspective, a paired signifiers and signifieds, whether they are part of other symbols or in Chinese characters, should maintain the consistency of the signifier and signified. This is the case for imagery components, and it is the same across all layers, including every imagery icon, so as to maintain the consistency of the imagery across the entire Chinese character system. Therefore, only by ensuring the omni-directional consistency of the imagery can the whole system be closely connected and comply with scientific and systematic norms. At the same time, this is also necessary to avoid the of "vulgarization" of imagery glyphs and to ensure efficiency in learning Chinese characters. For example, "良" is composed of the icons "日" and "宀". The imagery icons represent the sun and walking on both feet; together, they represent "Kuafu (夸父) chasing the sun to Yugu (a prehistoric boundary or limit)". This is mythical imagery. Travelling west, Kuafu meets a high mountain (in traditional Chinese geography). When combined with other characters, such as "根", "即", "既", "艱", "良", "垠", "很", "恨", "狠", "限", "眼", "退", "莨", "痕", "眼", "硯", "裨", "跟", "銀", "簋", "齷", "諛" and "琅", this character plays the same "initial" role.

Objective configuration

The principle of objective configuration has two requirements. On the one hand, an imagery glyph or imagery component must be composed of an imagery component or imagery icon. In other words, it cannot be separated from its imagery component or imagery icon and subjectively talk about the imagery component or imagery glyph. For example, the imagery glyph of "意" cannot be separated from the imagery glyphs of "音" and "心"; it is the result of their joint construction according to the appropriate combination model. Similarly, the imagery glyph of "音" cannot be separated from the imagery glyphs of "立" and "日". The imagery glyph of "心" cannot be separated from the imagery icons of "乚" and "丿" but is formed by them.

On the other hand, the imagery glyph, imagery component, and imagery icon are presented with their carriers, and the combination of imagery is also a combination of configurations. Regular script glyphs are already standardized, and using more, less, or arbitrary movement to increase or decrease the size of strokes is unacceptable. Because these script glyphs represent underlying imagery, any irregular shape changes will destroy the imagery and their construction and affect the consistency of the system. Therefore, the principle of objective configuration again refers to taking these regular script configurations as objective phenomena themselves; changing them will result in a change of rationale.

Interpretability

Interpretability mainly refers to the analysable interpretative relationship between an imagery glyph and its meaning. Specifically, the imagery of a Chinese character (imagery glyph) has a cognitive and empirical representational connection such as the conceptual, metaphorical, gestalt, and schematic models that determine the meaning of the character it refers to. This representational connection indicates the interpretability of the imagery glyph and the meaning of the character.

We know that there are three main forms of mental representation in human brains regarding elements of the external world: imagery, text, and propositional form. Since alphabet writing systems are phonetic, there is an arbitrary relationship between phonetics and the objects represented by different words. Therefore, from the perspective of cognitive psychology, mental imagery and text are two opposite types of representation (dual-code theory): the former is an analogy or metaphorical relationship, while the latter is an arbitrary relationship (or a conventional relationship). The former is more specific, and the latter is more abstract. However, Chinese characters are different. Chinese characters are ideographic, and this attribute is achieved through imagery. This imagery is the basis for Chinese character configuration coding. The five combination models we have compiled are the result of combining and constructing this imagery and the result of constructing a glyph. Therefore, Chinese characters are empirically connected with the meanings of their components through cognitive representations such as concepts, metaphors, gestalts, and schemas. This kind of connection is the imagery representation of concepts that originate from humans' experience in various situations. The ideographic relationship between a glyph and its meaning within Chinese characters is not an arbitrary relationship; the glyph itself contains rich cognitive information, which represents the experience it evokes and therefore its meaning. This is a unique ideographic characteristic of Chinese characters, differing greatly from alphabetic writing systems. Chinese characters require the double-code unification of the imagery formed by various meanings and the symbols encoded in the imagery. This double-code unification relationship indicates interpretability. For example, the configurational imagery of the character "水" (water) is "the swaying of a fish-hook causes water to ripple." This configuration of "水" is empirically connected with the concept of "水", which is comes across as more emotional than the phonetic code for "water". Because experience with water is a common experience, it has universal resonance, thus lending itself well to understanding the meaning of the characters it helps form. This is the greatest advantage of the direct representation of ideographic characters from experience. If someone has this experience, by following this code, understanding the meaning of a character is a natural process. The interpretability of Chinese characters is the basic principle of the theory of "character formation based on imagery".

Cultural common sense

Cognitive theory forms the theoretical basis of the theory of "character formation based on imagery", but the content of the imagery comes from observations of traditional culture and common sense. After all, people develop concepts through interaction with the environment through their physical and mental perceptions. The representation of the concept forms language, and language and action together form culture. Language, cognition, and culture jointly support the theoretical framework of the theory of "character formation based on imagery". Therefore, language, cognition, and culture are the historical basis for the invention of the formation of Chinese characters, and designers cannot escape this historical reality. If we return to the historical and cultural scene when designing the Chinese character configuration, it can testify to the imagery we are exploring. At the same time, it can also provide a basis for understanding

the meaning of the character. This kind of ideographic writing linked with experience and common sense contains a wealth of knowledge in itself. This is a very empirical writing system.

These four principles are the necessary conditions and criteria for exploring the imagery glyphs, imagery components, and imagery icons of Chinese characters. Although the imageries that meets these conditions is not the only one in the process of exploration, as long as these four principles are met, various imageries speculations can compete with each other, and those with strong interpretive ability must remain. But in any case, meeting these necessary conditions is the guarantee that the Chinese character system is scientific and efficient.

Methods

Exploring imagery glyphs, imagery components, and imagery icons requires actionable strategies and methods. Overall, we adopt a "reverse engineering" strategy: a strategy for tracing the cause through the results. That is, the known meaning of a character is used to explore the imagery glyphs and components until the imagery icon appears. Of course, these explorations must follow the four norms of imagery. However, we mainly use four methods.

One is to follow the commonly used component analysis method or structure analysis method in linguistics, sort out the three-level two-track structure of Chinese characters. That is to find out the icons, components and hierarchical structure of the Chinese character system.

The second method is induction. This is the use of two characteristics of Chinese characters: 1. The configuration is combined; 2. The meaning of the character is polysemous, so that a certain component or Chinese character appears in many different Chinese characters, and these different related Chinese characters are polysemous, so that we can collect the meanings of these characters, including their polysemy, and use them as speculative judgments of the imagery of the component or Chinese character, so that the inferred imagery can explain the meaning of these characters. In fact, modern lexical semantics uses a massive corpus and numerous retrieval tools to complete statistical induction to study semantics. However, we mainly use this method within Chinese characters. Extracting the imagery components and the imagery glyphs from the multiple meanings of many related Chinese characters is the creative highlight of our research method.

Of course, an inductive process must conform to the four principles of conjectured imageries, among which the search from culture is the most critical. For example, if we want to determine the imagery component for "艹" on the right side of the character "漢", we need to find the characters "漢", "難", "艱", "嘆", "歎" and "嘆" within the system (nine thousand commonly used Chinese characters) because these characters all contain "艹". Then, based on all the meanings of these characters (including their polysemous meanings), the imagery of "艹" can be summarized as a raft: an aquatic bamboo raft that is made by inflating animal skins and is popular in the Hanjiang River Basin (漢江) in Northwest China. Of course, this raft must conform to the four principles of

speculatory imagery mentioned above. It must not only conform to historical facts but also explain the numerous meanings of the aforementioned characters and conform to the imagery component of the lower portion on its own: "艹夫". From this example, we can see that the imagery glyph being explored is empirically backed cultural imagery, and it contains rich content references. At the same time, the imagery is also drawn from a summary of the multiple meanings of many related Chinese characters. Therefore, the imagery of the character formation can explain its polysemous character meaning. For example, the character "漢" means "a raft surrounded by waters". Although this imagery directly reflects the waters of rivers, it is also a geographical concept; thus, the people in this area are called 漢人 (the Han), and the language used by these people is called 漢語 (Chinese). The characters used are called 漢字 (Chinese characters). Because the founder of the dynasty was a figure from this area, this character was designated the name of the dynasty (漢朝 Han Dynasty). Thus, we can examine the nine thousand regular-script Chinese characters to determine their previously unknown imagery components using this induction method. Therefore, this is a massive, complicated, and long-term task that requires patience because it affects the whole body of Chinese characters and requires constant adjustment.

Third, many Chinese histories, such as "Shuowen Jiezi (說文解字)", the "Kangxi dictionary (康熙字典)" and other historical documents, have become classics [1, 19]. Some predecessors have interpreted them, even re-annotating the classics. If some existing explanations conform to the abovementioned four principles for inferring imagery, we may wish to use them. Thus, literature analysis is the third of our four research methods.

Fourth, Chinese characters are ancient characters, like antiques, and they thus have historical textual value. Therefore, understanding various historical and cultural contexts and events through textual research is another way to explore imagery glyphs, imagery components, and imagery icons. The textual research method is our final research method. For example, when we understand the structure and performance of the Guqin (古琴), it is not difficult to imagine the imagery of the "彳山攴" component in the characters "徽", "徵", "微" and "徽": the wonderful fingers touch silk strings on the Guqin Yueshan (古琴岳山). After exploring this imagery component, this series of imagery glyphs ("徽", "徵", "微" and "徽") can be easily broken down into parts.

Results

To explore the imagery glyph, imagery component, and imagery icon of the Chinese character system, including the components and the icons that carry them, we selected nine thousand commonly used regular-script Chinese characters as a fully objective and generalizable representatives for the system. After long-term digging, the imagery of these Chinese characters that have been sleeping for thousands of years reproduces the world. They are our greatest achievement. They make the hypothesis of "character formation based on imagery" have a solid theoretical foundation.

These results show that there are 87 icons and imagery icons,

they form the entire character word system like DNA, which shows that this system is very dense and efficient. The highest level of component combinations is ten. Table 4 shows the hierarchical distribution statistics of these nine thousand Chinese characters. Table 4 shows that most Chinese characters appear in the fourth and fifth layers. These are as many as eight thousand Chinese characters in the sixth level. These nine thousand Chinese characters are constructed and arranged in layers, providing a natural order for learning Chinese characters, and imagery glyphs and imagery components provide the basis and norms of memory coding for the construction of shapes. In addition, we

also calculated statistics on the distribution of the five combination models within the formation of nine thousand the imagery glyphs, as shown in Table 5. Of course, some combinations are compound combinations, that is, two or more combination models work together. Table 5 shows that the conceptual model and the schematic script model are most prevalent. The regular script system and ancient Chinese character system are shown in Table 6. The number of imagery glyphs and their components and the number of imagery components of the nine thousand Chinese characters are very large, so here, we show only 25 characters and 25 icons in Table 7.

Table 4: Statistics on the hierarchical distribution of nine thousand Chinese characters.

Icon 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8	Level 9	Level 10
87	297	1244	2606	2589	1339	671	103	108	33

It can be seen from Table 4 that most Chinese characters appear in the fourth and fifth levels, and 90% (eight thousand) appear on the sixth level.

Table 5: Statistical distribution of the five combination models within the formation of nine thousand the imagery glyphs, including compound combinations.

C	D	G	S	M
5578	90	2247	1446	4040

Table 6 Comparison between the regular script system and other Chinese character systems.

Table 6: shows that the regular script system is more systematic than the “Shuowen Jizi” (說文解字) system.

text type	total counted	icon	average icon
Oracle released	1380	412	3.3
Qinjian sampling	1773	361	4.9
Shuowen Jizi	10422	414	25.05
Regular script	9032	87	103.82

Table 7: 25 characters and 25 icons, including their imagery.

Icon	Imagery icon	Chinese character	Imagery glyph	Component	Imagery component	Component	Imagery component
、	突出之點	丁	上壓下頂(打木楔)	一	盤古在卵內的世界	丿	刀鉤利器
	上下貫通	卜	灼龜甲通天地	、	突出之點		上下貫通

Conclusion

After we completed the disassembly analysis of the nine thousand regular script Chinese characters and used the meaning of the characters to reverse their imagery glyphs, imagery components, imagery icons, we confirmed that the " character formation based on imagery " hypothesis has theoretical value, because the imagery constructed by the configuration can not only explain the meaning of characters in theory, including their polysemy phenomenon, but also implement more concretely on 9,000 Chinese characters. In other words, this theory explains the ideographic relationship between the meaning of the characters and their glyphs; it explains why the same components appear in different Chinese characters, and it also implements their combination patterns to nine thousand Chinese characters.

These results can also regard Chinese characters as an imagery-based theory Chinese character information configuration, which is a mental representation of meaning. This method directly reflects cognitive experience, that is, directly connects meaning with the empirical imageries that represent these meanings. Therefore, learning Chinese characters is also a process of constructing or reviewing empirical knowledge. And these large amounts of information configuration that directly characterize and explain knowledge directly provide an empirical imagery landscape for understanding the concept of these Chinese characters. For example, how to understand the concept of “數” (number). We can understand “數” from the imagery glyph reflected in the configuration of this character. The imagery glyph of “數” is “to count the amount of goods in the female slave basket”. It reflects that the concept of “數” arises from the mea-

surement behavior of transported goods. Therefore, this method of mental representation has practical value for understanding the concept of the characters.

In addition, these nine thousand Chinese characters are constructed by hierarchical combinations, that is, each Chinese character is the result of the combination of its lower-level Chinese characters or components or icons. This method of using existing configurations to construct new characters provides a natural sequence of connecting the old and the new to the learning of Chinese characters. At the same time, these imagery glyphs and imagery components provide a visual experience context for memory coding. And their corresponding configurations (including multi-character words) are only the result of repeated combinations of 84 icons. Therefore, these characteristics make it possible to learn Chinese characters efficiently.

For thousands of years since “six principles” theory, Chinese character theory has been unable to clarify the meaning of configuration, even though Xu Shen has solved the ideographic problem of radicals of the characters. In other words, the configuration of Chinese characters has been unable to fully and thoroughly explain the meaning and sound of the characters, let alone the explanation of the ambiguity of the characters. The linguistics of the alphabetic writing system treats Chinese characters that are not directly phonetic as foreign. Therefore, the glyph, sound and meaning of Chinese characters have been in a state of separation and isolation since the past. The morphology of the Chinese writing system is also in a state of no foundation. Now, the theory of “character formation based on imagery” can fill these gaps. For example, the combination rules from icons to imagery glyphs can correspond to the phonology of linguistics (see Table 3), from imagery glyphs to meaning of the characters to character words can be regarded as the morphology of ideographic linguistics. In other words, the “nerve vein” of Chinese writing system has been opened up from the configuration characters to the character words. These results help propose a guiding theory for character word formation in the Chinese writing system. It also provides human beings with a way of writing based on the mental representation of visual experience in addition to logocentrism. This provides the possibility of general communication in the future world.

Finally, what needs to be explained is that the imagery glyphs, imagery components, and imagery icons we have explored are not the end. In the future, anyone can propose better interpretations of the images, as long as these interpretations conform to the norms of the four principles. The “character formation based on imagery” theory we put forward is just an attempt and a beginning, we hope to attract more scholarly attention and participation to develop and refine our theory.

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