Orthography Decoding in Chinese: Main Features and Theories

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Abstract

This paper focuses on the phenomena related to the Chinese writing system and word recognition providing evidence for some forms of speech representation at the syllable level. It will be suggested that Chinese presents inherent features which allow, to some extent, a speech-based reading. Such a claim is consistent with the hypothesis being supported by Tzeng (2002), Perfetti and Zhang (1991, 1995), claiming that phonology can also be activated by phonetic, graphic and semantic stimuli. In this way, it will be shown that just as the alphabetic visual shape can be read as “ideograms”, in a similar (but specular way), also Chinese characters can be processed through a phonological mediation.

Keywords: word recognition, writing system typology, Chinese character recognition

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1. Introduction

A great deal of research has been focussed on visual Word Recognition (WR). The written language is exceptionally useful and studying it should have critical implications for teaching Chinese as a second language. Chinese is typically referred to as the most phonologically ‘deep’ orthography, that is, the writing system with the most arbitrary spelling correspondence. Since there is no “1-to-1” correspondence between sign and sound, it is easy to assume that reading Chinese characters involves only the meaning-based writing system, whereas in WR there is the resort to the direct route from graphic input to meaning. However, in the literature, it is accepted that more than 80% of characters consist of phonetic compounds, each of which is composed of semantic and phonological units that do not regularly contribute to the phonetic realisation of the word.

This paper focuses on the phenomena related to the Chinese writing system and WR providing evidence for some forms of speech representation at the syllable level. It will be suggested that Chinese presents inherent features which allow, to some extent, a speech-based reading, similar to English and other languages in the family of alphabetic languages. Such a claim is consistent with the hypothesis being supported by Tzeng, Perfetti and Zhang, claiming that phonology can also be activated by phonetic, graphic and semantic stimuli. This article provides a comprehensive description of the most recent findings on the Chinese writing system, referring them to the general issue of WR. Section 2 will introduce basic methods and findings in the area of psycholinguistics, with particular reference to the different WR models. Section 3 will present the most common typological classification of the different writing systems, whereas Section 4 will address the language-specific issues concerning Chinese, also providing a brief historical account. In Section 5, based on the seminal work by Rogers (2005) and other literature, three major decoding routes will be described and presented (grapheme-to-phoneme, morpheme-to-phoneme and...

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4 Tzeng, "Current Issues in Learning to Read Chinese".


7 That is to say that in Chinese writing decoding a “character regularity effect” is more likely to use the phonological mediation path Evelyn Witruk, Angela D. Friederici, and Thomas Lachmann, Basic Functions of Language, Reading and Reading Disability, Vol. 20, Springer Science & Business Media, 2002, 25. This theory is competing with a different framework stating that in Chinese the process of retrieval takes place mainly at the graphic level. The direct access theory stipulates that the process from grapheme-to-phoneme is instantiated faster than phonological recognition. In order to prove the validity of this hypothesis (related to the delayed-phonology hypothesis) experimental tests are being conducted based on two main techniques: masking and priming; such studies lead to the claim that: “Graphic to meaning” path has been formed from the very beginning of character process and remained the same for L2 Chinese learners, see also Gao Liqun (高立群) and Meng Ling (孟凌), "Wàigúó liúxuéshēng hányǔ yuèduā zhōng yīn, xìng xìn xiú diá hánzì biānrēn de yǐngxiǎng" (外国留学生汉语阅读中音、形信息对汉字辨认的影响) [the Impact of Phonological and Orthographic Code in Character Recognition by Foreign Students], Chinese Teaching In The World 世界汉语教学, 4 (2000), 67-76.
grapheme-to-morpheme). In this way, it will be shown that just as the alphabetic visual shape can be read as "ideograms" (Section 1), in a similar (but specular way), also Chinese characters can be processed through a phonological mediation.

2. Theoretical models on lexical access and orthography decoding

2.1 Threshold level of activation

Since the seminal article by John Morton, the process of recognition has been analysed through a set of phases, where each one implies access to different types of information: graphic, phonological, semantic and finally lexical. Each stage in the process represents a node in the cognitive process, also called logogen (Greek meaning "word generation"), which describes the basic unit in the recognition process. Each logogen has a specific threshold level that must be activated in order to move to the next stage. Broadly speaking, it could be said that the Orthographic Lexicon Threshold is "determined by the frequency of occurrence of the printed character in the reader’s daily usage" whereas the Phonological Lexicon Threshold is determined by "the frequency of access to the character’s phonological form in the reader’s speech experience". When each node is fully activated (in other words, when it exceeds its ‘activation value’), it excites the nodes with which it is consistent and it inhibits the nodes with which it is not. I have just provided a simplified picture of the process, however, for a better understanding of the topic, in the next section, I will offer a more detailed outline of the influential models on word recognition based on Morton’s pioneering research.

2.2 Word recognition and lexicon access

As underlined by Harley, when it comes to the recognition of a word, psycholinguistic researchers are not only interested in how we decide if a printed word is familiar or not, but also in how we access all the information related to the word, such as meaning and syntactic class. There has been consistent emphasis on the gap between word recognition and word meaning access. The key issue on the matter is whether recognition and access take place at two different stages or rather in a continuum. Such a gap is first named by Balota as “the magic moment”, which refers to a discrete moment in time when the subject has recognised the word but has yet to access meaning. By using Balota’s terminology, it could be said that in Morton’s framework the magic moment takes place when a logogen’s threshold is reached and surpassed. According to the bin model outlined by Forster (1976), the magic moment instead happens when the representation of the orthographic stimulus sufficiently matches with the information stored in the storage for lexicon information (that is, the bin of lexical access). Both the notions of logogen threshold activation and of a matching between an original stimulus and inner lexical storage are

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reinterpreted in Becker’s verification model (1980). The basic difference is that for Becker the logogen system response provides a “set of candidates” matching with the stimulus. Such a set (corresponding to the sensory representation of the stimulus) is then verified against the sensory memory. What these models have in common is that an orthographic stimulus activates the retrieval of lexical information, which is a mechanism that can be triggered by the threshold activation or by a comparative process between external stimuli and internal representation.

2.3 The dual route approach in the reading process

The research on the decoding process, from the visual stimulus to lexical access, is also at the centre of the investigation on the reading process, which is generally broken down into two distinct areas, that is, reading aloud and reading comprehension. If we start from the assumption that this context involves the computation of three types of codes: orthographic, phonological and semantic, then fundamental questions arise. What are the relations between these three dimensions and what is the direction of activation of their respective different thresholds? Is it unidirectional or bidirectional? As highlighted by Coltheart, the idea of two parallel paths (as an antecedent of the current dual-route DR approach) has been proposed at the very foundation of general linguistics, as visible in this passage from the Cours de linguistique générale, by Ferdinand de Saussure:

...We read in two ways; the new or unknown word is scanned letter after letter, but a common or familiar word is taken in at a glance, without bothering about the individual letters; its visual shape functions like an ideogram.

By the beginning of the seventies the DR theory had already gained wide currency also in psycholinguistics. It was explored by Marshall and Newcombe (1973) (see Figure 1), Forester and Chambers (1973), Baron and McKillop (1975) and Baron (1977), who outlined an arrow-and-box diagram describing the whole process of lexical recognition. An example of the arrow-and-box diagram is visible in Figure 1 and it represents the whole reading aloud process according to the dual-route approach. As illustrated in the diagram, there are two possible paths leading from print-to-speech. One is the grapheme-to-phoneme path. The other is the grapheme-to-meaning route, where the orthographic information is processed as visual shape (and not as individual letters) and where lexical retrieval takes place independently from the access to the phonological representation. Since

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sound is not involved, the grapheme-to-meaning strategy is crucial in identifying homophones, especially when they are embedded in ‘insufficient’ context. For instance, in a sentence such as “give me a pear”, in order to process the word ‘pear’, we cannot rely on the phonemic representation /pɛə/, which is the same as ‘pair’; therefore, we have to use the print-to-meaning route (Baron and McKillop 1975).  

We will go back to these notions in the following sections, but before then, we need to mention the application of computational modelling in this field of investigation.

![Diagram of the reading process by Marshall and Newcombe (1973), from Castles et al. (2006)](image)

2.3.1 From Arrow-and-box to computational models

These early models have the limitation of being simply “box-to-arrow” type, meaning that they capture the main sequence of the process of an input up to the production of an output. However, they neither explain what exactly happened in each stage, nor explicate how information is being operated from one point to the another. In the early 1980s, with the emergence of new and more sophisticated models used in computational science, the scientific community gained a better idea about what is taking place in each phase and what is going to happen in the next phase. Moreover, while “the magic moment” idea has been widely accepted and supported by empirical evidence, Balota himself has raised questions about the methods and data collecting procedures which have been commonly used to tap such models. In other words, a different model emerged from the literature, according to which “lexical processing may reflect a more continuous, cascadic flow of information”.

The computational ideas were initially used to examine complex nonlinear systems, such as weather-forming processes in meteorology. When applied in psycholinguistics, as stated by Noam Chomsky, they “were also fundamental to understanding human language in another way”. In fact, the way we process and acquire language is characterized by a computational mechanism, therefore, it is not surprising that these models have been a

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21 Ibid, 9.
22 Dennis Norris, "Models of visual word recognition", *Trends in cognitive sciences* 17/10 (2013), 517-524.
central topic in the field of psycholinguistics (Ibidem). Their working principles can be described as follows:

These models are intended to explain how some psycholinguistic function is accomplished by a set of primitive computational processes. The models perform a psycholinguistic task and produce behaviour that can be interpreted as a set of predictions to be compared to human data.²⁴

### 2.3.2 Interactive Activation and Competition (IAC)

With reference to lexical retrieval, the earliest and most influential computational models are characterized by Interactive Activation and Competition IAC. These models are inspired to human brains and view the whole WR process as an artificial network with in-built and densely interconnected nodes. Neuronal-network algorithms, such as the back-propagation learning algorithm, are applied to simulate human language processing. Therefore, to some level, IA models function in a similar way to our brain, where a large number of interconnected neurons work simultaneously and cooperatively. In such a connectionist framework, “letter features, letters, and words are represented as nodes”²⁵, which excite or inhibit one another across the network.

An example of an IA minimal architecture framework is visible in Figure 2, representing the process of reading the word *make*; the connections between units on different levels are represented by arrows that “always run in both directions, in keeping with the assumption of interactivity”.²⁶ As highlighted by the authors, the main assumption is that “the process of building a representation at each of the three levels [orthography, phonology, and semantics] both influences, and is influenced by, the construction of representations at each of the other levels” (Ibidem). In this case, the process relies only on the interaction between the orthography and phonology pools (in boldface type); such a route is possible given the features of the word *make*, where grapheme and phoneme are matched according to regular rules, but would not be viable for a word such as *have*, where sound and sign are mapped in an irregular way (according to the general rule, *have* would be read as *cave*).

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²⁵ Norris, "Models of visual word recognition", 518.
²⁶ Seidenberg and McClelland, "A Distributed, Developmental Model of Word Recognition and Naming", 526.
²⁷ Coltheart, "Modeling Reading: The Dual-Route Approach", 17.
2.3.3 Dual-route cascaded model (DRC)

The interactive activation computational models have further developed through the dual-route cascaded (DRC) models, whose theoretical assumptions have been anticipated by the DR approach. In this section, I will focus on the investigation by Max Coltheart, whose account I have relied upon in several points of this article, and whose modelling on DR started from the arrow-and-box type (1978) moving on to the computational model on reading. As anticipated in the previous section, the DR approach had already postulated that when processing high frequency words, morphemes such as affixes (Barron 1977), and homophones (Baron and McKillop 1975), the preferential route is grapheme-to-meaning; whereas, the way from the “grapheme-to-phoneme” is typically used for words that are new to the reader, for which the pronunciation is retrieved directly from the phoneme sequence. In more recent research, Coltheart et al. devised a computational model based on two alternative procedures for computing pronunciation from print. The first procedure is lexical, that is the printed input is retrieved from the mental lexicon; the second is non-lexical, that is “involves making use of rules relating segments of orthography to segments of phonology”. The DRC model is visible in Figure 3. Differently from the connectionist model by Seidenberg and McClelland, this processing route is usable with nonwords (as sare), in addition to regular words (as make) and irregular words (have).

![DRC Model Diagram](image)

Figure 3: The DRC model by Coltheart et al. 2001

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29 Baron and McKillop, "Individual Differences in Speed of Phonemic Analysis, Visual Analysis, and Reading".
31 Coltheart, "Modeling Reading: The Dual-Route Approach", 9
32 Seidenberg and McClelland, "A Distributed, Developmental Model of Word Recognition and Naming", 526.
33 Coltheart, "Modeling Reading: The Dual-Route Approach", 12.
In sum, whether they refer to DR, IAC or DRC, all these theoretical models account for a correlation between the decoding strategy (lexical or non-lexical), the type of lexical material (high/low frequency, homophone, nonwords etc.) and orthography (regular or irregular mapping between letters and sounds, etc). Therefore, in this analysis we need to turn our attention to the different writing systems. Before then, we must briefly outline the connection between these computer-aided experiments and the major investigations on human reading performance.

3. Word recognition and writing system

A variety of writing systems have developed in human history, displaying striking differences, such as alphabetic systems (speech-based) and logographic ones (often described as “meaning-based”). Such diversity gives space to the essential questions: Are all readers using the same way of processing visual stimuli (written words)? How does such a process vary according to the writing system being used? Notwithstanding the considerable amount of debate and controversies, at present there are no straightforward conclusions. Since the turn of the century, different “universal hypotheses” have been outlined. At stake is the role of phonology in the process of visual word recognition. In the model described in section 2, a route from grapheme-to-phoneme had been outlined (parallel to a grapheme-to-meaning path). This postulation was not meant to indicate that lexical access is necessarily phonologically mediated, and it was instead predicted that such a procedure is used productively in a specific context, as with nonwords or for readers who have not developed an advanced reading skill. Here I will present the main hypotheses which, though making constant reference to IAC or RDC, are not based on instantiated models. Instead, they draw upon evidence from second language acquisition and from clinical experience on different types of speech impairment, either in language-specific or in cross-linguistics contexts.

Based on the role that phonology plays in the realisation of visual word recognition, the following main hypotheses must be accounted for:

- the Universal Direct Access UDA;\(^{34}\)
- the Phonological Mediation Hypothesis PMH or Strong Phonological Hypothesis;\(^{35}\)
- the Universal Phonological Principle UPP.\(^{36}\)

The UDA theory claims that all writing systems use a visual route which directly leads to word reading (grapheme-to-meaning, that is, the equivalent of the lexical procedure we discussed above). During the process, the visual features of the stimuli are matched to the orthographic information in the reader’s internal dictionary (or mental lexicon), hence, the meaning is retrieved. Phonological processing happens occasionally, and is therefore not a mandatory constituent of the process. Van Orden and Kloos describe DA as follows:\(^{37}\)

Direct access takes a visual representation of the word as input and assigns


it to an abstract placeholder in the mental lexicon. Identification of a word happens in one step going from a visual representation to an entry in the mental lexicon. It is called direct access because it creates a shortcut that bypasses the grapheme-phoneme rules. To link each word’s visual representation to a lexical entry requires word-by-word associations. The links develop as a reader becomes familiar with words.

The dual-route approach is a contender to this view. In fact, as underscored by Frost,\(^\text{38}\) the DR theory posits that the reading process involves an interplay between phonological computation (non-lexical route) and visual orthographic processing (lexical route). Moreover, though DR predicts that the preferential route might vary according to the type of orthography (we will talk about this topic in the next section), it also postulates that the prerequisites for skilled reading are the acquisition of the orthographic representations (resulting from frequent exposure), and the ability to draw upon grapheme-to-meaning bypassing the grapheme-to-phoneme route.\(^\text{39}\) In sum, for skilled reading the phonological process is viewed as either a contingent necessity, or an \textit{ultima ratio} resorted to by unskilled readers.

In the PMH, the written input triggers automatically, and very rapidly, the activation threshold of the phonology node, independently from the writing system and the reading skills. From there, the phonological information is retrieved and the corresponding word meaning is accessed. However, there are scenarios where the phonological computation is not accurate enough (typically due to the kind of orthography being used). In those contexts, to retrieve an accurate representation of the word, a “lexical reshaping” is in order. Perfetti \textit{et al.} fine-tuned this framework with reference to the specific writing systems being used.\(^\text{40}\) Drawing from the claim that phonology is an essential constituent which is activated whenever a graphic input is encountered, we posit that the specific levels and details of phonological activation are also determined by the features of the orthography which instantiates it. It is therefore now time to turn our attention to the typological classification of the writing systems.

3.1. A typological classification of writing systems

As a general rule, the different systems vary mainly based on orthographic units.\(^\text{41}\) There are orthographic units which transcribe sub-syllabic units, that is, phonemes, as in English; others which transcribe syllables (or more precisely, moras), as in Japanese kana; in the case of Chinese, the linguistic unit being transcribed corresponds to a morphosyllable, that is, a Chinese character simultaneously represents a syllable and a morpheme.

Most writing systems are alphabetic; therefore, they are based on sub-syllabic units. The mapping of a letter onto sound is typically consistent, but there can also be inconsistencies, due to diachronic variation or other factors. Such inconsistencies thus create areas of \textit{opacity} where the grapheme to phoneme pattern is not regular. Since Klima,\(^\text{42}\) the

\(^\text{39}\) Ibid.
\(^\text{40}\) Perfetti, Zhang and Berent, "Reading in English and Chinese".
\(^\text{41}\) Frost, "Orthographic Systems and Skilled Word Recognition Processes in Reading".
description of these phenomena has led to a typological classification of writing systems, based on their grapheme-to-phoneme consistency, where one-to-one relations are the optimal orthography. In a perspective based on how predictable the pronunciation is from the visual word, there are cross-linguistic shallow and deep orthographies. Shallow orthographies are those which have a more consistent correspondence between sign and sound (tending to a “one to one” match) such as Serbo-Croatian, Italian, Spanish, German, Finnish and so on. In other languages such as Danish, this relationship is not entirely predictable, therefore it is more opaque. Finally, there are languages such as English, in which the correspondence between sign and sound is often irregular and is thus labelled as deep.

In this framework, Chinese is obviously classified as one of the world’s most phonologically ‘deep’ orthographies. To accommodate this kind of writing system, a broader system is needed, possibly one that is not conceived for writing systems based on subsyllabic units. A classical taxonomy was outlined by DeFrancis (1989): (1) ‘pure’ syllabic (as Linear B, kana and Cherokee); (2) morpho-syllabic systems (Sumerian, Chinese and Mayan); (3) morpho-consonantal systems (Egyptian); (4) ‘pure’ consonantal (Phoenician, Hebrew and Arabic); (5) ‘pure’ phonemic (Greek, Latin and Finnish); and morpho-phonemic (English, French and Korean).

In English, writing refers to different domain: a style or form of composition; the art of forming visible letters or characters – handwriting. The definition of writing provided by Rogers is: “the (systematic) use of graphic marks to represent specific linguistic utterances”. Not every language has a written form, and for those which do have a “well-established” writing systems, not all those people who can speak the language can write it. Language can be acquired in a natural process. As a result, all people acquire at least one language as children. However, writing can only be taught and learnt consciously and sustainably.

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46 Ibid.
47 George Yule, The Study of Language (Cambridge: Cambridge University Press, 2010), 212.
48 Ibid, 212.
Though writing is the visible realisation of a language, it does not necessarily reflect or represent all the linguistic details (related to sound and meaning) of the language. Most of the time writing represents a combination of sound and meaning, for example, English, Chinese, etc. In Rogers’ typology of writing systems, one representing pure meaning is classified as morphographic (with the only example - Bliss), the rest are all phonologically based, and are classified as phonographic. In some types of the phonographic writing, all the smallest phonological units of the language are represented, e.g. Finnish, in which case a segmental writing system reflects all the consonants and vowels. However, in some other cases, only a part of the phonological details is represented. For example, Arabic, being a Semitic language, has typical Abajad or consonantal features so that all the consonants are represented but not the vowels.49

3.2 Writing systems: phonographic and morphographic

Another interesting aspect of the relationship between writing and language is how perfectly the written symbols match the utterance. In other words, different taxonomies have been defined to classify languages based on their decoding patterns. In this account, I will rely on the framework outlined by Rogers (2005). Phonographic writing systems consist of phonemic writing systems, moraic writing systems and syllabic writing systems, according to the size of the phonological units: phoneme, mora, syllable, from small to large. The primary relationship of graphemes in phonographic writing systems is to phonological units. Segmental or alphabetic writing systems being the most commonly used writing system is a type of phonemic writing system. In a phonemic writing system, “a regular one-to-one relationship between grapheme and phoneme” would be expected, in such a situation, an automatic conversion is possible because there is a distinct written symbol for each phoneme.50 However, a pure and perfect phonemic writing system does not even exist in Spanish, which is one of the closest examples of a fair, regular and consistent one-to-one relationship. While most of the time this relationship in Spanish is predictable, exceptions do occur. Rogers takes one grapheme <h> and one phoneme /b/ as examples. In the case of <h>, there is no corresponding sound in the language. As for sound /b/, it can be represented by both graphemes <b> and <v>. Under such circumstances, morphemic information would be needed to decide the exact word. A great deal of morphemic information is necessary in the English writing system where this relationship, on the other hand, is much less predictable. For example, the phoneme /i/ can be written as orthographic symbols <ee, ea, ie, ei, y, i> as in meet, mean, siege, conceive, city, spaghetti,51 or words sound the same but have different spellings, e.g. air-heir. Similarly, there are individual graphemes which have different sounds, as <a> in bag and bar; or writing sequences such as <ea> are pronounced differently in leap, gear, bear. With this ambiguity, lexical and morphemic considerations need to be taken into account in order to decide the desired written form or sound. According to the amount of morphological information required, phonemic writing systems can be viewed as a continuum with Spanish in one extreme (shallow), English in the other extreme (deep). Other phonemic languages (German, French, Greek, Scots Gaelic, Mongolian, etc.) sit in between.

Mora is a phonological unit with the intermediate size between a phoneme and a syllable. In a moraic writing system, graphemes are related to moras instead of to phonemes

50 Ibid, 6.
51 Ibid, 5.
as in alphabetic writing systems. Japanese kana, Cherokee are typical moraic writing systems in which an onset-nucleus combination (mora) would be a polyphone. It means that a grapheme would represent more than one phoneme; and this phenomenon is usual. A coda is also a mora.

In syllabic writing systems, graphemes are related to phonology at the syllable level. A complete syllable consists of an onset, nucleus and coda. The only clear syllabic writing system is a Chinese dialect: Yi.\(^{52}\) Chinese is classified under different categories in different classification: word syllabic,\(^ {53}\) syllabic,\(^ {54} 55\) morpho-syllabic,\(^ {56}\) logographic.\(^ {57-58}\) In this paper I follow Sproat and Rogers. In other words, I believe that Chinese, considering the significant number of phonological symbols in its system, the syllabic argument appears to be more valid than the remnant.

In conclusion, phonographic writing systems are categorised by the size of the phonological units. A same graphic sign can have a different number of units under a different writing system. For example, *cut* has three phonemes written in three graphemes in alphabetic writing, two moras written in two moras in moraic writing and one syllable in one grapheme in syllabic writing.\(^ {59}\)

Morphographic writing systems, unlike phonographic writing systems, have graphemes (here called morphograms) which are primarily related to the morphemes. According to some scholars such as DeFrancis,\(^ {60}\) all writing systems are phonologically based and a pure morphographic writing system seems impossible. Rogers disagrees with this claim and gives the example of a pure morphographic writing system, i.e. Bliss.

4. **Chinese language-specific features**

Chinese writing was invented at least 3500 years ago (Shang Dynasty) in north-central China. The earliest clear evidence from history is interpretable inscriptions found on bones (ox scapulas and turtle plastrons).\(^ {61}\) They are called *oracle-bone writing* (甲骨文) because they were records of royal prophecies. Those characters carved in bones are the direct antecedents of the characters in use today.\(^ {62}\) Though they are no longer recognisable by those who only know modern forms and because of the appearance changes, the fundamental structure of the characters is more or less the same.

Chinese writing had experienced unbalanced and independent regional development in addition to changes arising from the use of diverse writing materials (bamboo, silk, etc.) on which the characters were executed. There were a great number of ways to write the same character in different contexts and places. Writing was first standardised and unified by Qin Shi Huang more than 2000 years ago and has remained unified ever since. However, the

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56 DeFrancis, *Visible Speech: The Diverse Oneness of Writing Systems*.
58 Bernard Comrie, *Writing Systems*. Available at: http://wals.info/chapter/141 [accessed on 11.06.2017].
60 DeFrancis, *Visible Speech: The Diverse Oneness of Writing Systems*.
62 Ibid.
unified written form of Chinese does not remain the same without any changes. Chinese writing went through three phases in history:

1. Old Chinese roughly from 1100 BC to 100 BC (Qin Dynasty)
2. Middle Chinese 100 BC to 600 AD (Sui Dynasty)
3. Mandarin 600 AD to present

For the period of two thousand years from 100 BC (Qin dynasty) to the early 1900s, the written form was known as literary language (文言 wényán), that is an equivalent to Classical English in the English language. Classical Chinese is extremely concise and compact compared to Modern Chinese and requires intensive study for many years as it was not normally spoken. While Classical Chinese was used in writing, local dialects were used in speech. It creates a type of diglossia, and it is for all literate Chinese. A more vernacular and easier to understand written Chinese, (白话 báhuà, ‘plain speech’) had been prevalingly used in popular novels or stories. Plain speech was originally used in translating Buddhist scriptures dating to 300 BC. It founded the basis for the new written form: Modern Standard Chinese (国语 Guóyǔ, ‘national language’). National language whose spoken form is very close to Mandarin as spoken in Beijing, has been used from the beginning of 1900s. The language and script reforms in the PRC in the middle of the 20th century promoted a new version of Modern Standard Chinese (普通话: pǔtōnghuà, ‘common speech’) which is written in simplified characters; limited the number of characters for common use and also adopted a Romanised phonetic script to help learn the language.

There are seven major dialect groups spoken in China nowadays. Mandarin is one of them and is spoken in the northern and western areas. These dialects are quite different from each other to the extent that sometimes communication is unintelligible between speakers of the two dialects. It is easy to draw the conclusion that they are closely related languages rather than several dialects of a main language. Today, speakers of different dialects may speak their own dialect in formal or informal occasions, but writing is always done in the standard form of Chinese, except in a few situations where there is an intention to emphasise a particular dialect wording. This situation creates a different type of diglossia phenomenon for Non-Mandarin Chinese speakers, in which one dialect (any dialect except Mandarin) is used for speech and another dialect (Mandarin) is used for written.

Most commonly, writing systems are developed by borrowing or applying other languages. There are rare examples of writing inventions which are created from scratch. Chinese is likely to be one of the only three, the other two are Sumerian and Mayan. Almost all the writing systems in use today can trace their roots to either Chinese or Semitic. Rogers argues that Chinese is the only writing system which does not involve any sort of borrowing but develops and evolves independently, among all the writing systems in use today. Though it is likely to be true that there is no prior model of borrowing in the invention of Chinese, there are growing numbers of foreign loaned words used in Chinese vocabulary nowadays with globalisation.

Nevertheless, Chinese writing also influences the writing systems in several neighbouring countries in varying degrees. For example, in Vietnamese writing, the creation of characters has been inspired by general ideas such as Chinese character forming principles,

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66 Ibid, 4-5.
which resulted in phonetic-semantic compounds. Only the order of components is reversed as semantic-phonetic compounds are more common in Chinese.  

### 4.1 Structure of Chinese writing system

Traditionally, Chinese characters had been written starting at the top right corner of the page, proceeding from top to bottom, with each column placed after the previous row. But this arrangement has been replaced by modern horizontal linear organisation the same as English: left to right, one row after another. Each character fits in an imaginary square of equal size. The structure of Chinese characters has not changed much since the oracle-bone writing. The reason why characters are created with their own distinct features is associated with the condition and purpose of their creation and the Chinese traditional way of thinking and philosophy. There are three main factors contributing to the shape of a Chinese character:

1) The practical reason is that the original tools used to inscribe, such as stones or knives, and the hard writing surface (turtle, shell, bamboo or bronze) made it easier to write in square than in other shapes.

2) Ancient Chinese believed that the sky is round, and the ground is square. Space, time and mankind are a unified entity. Four (metal, wood, water, fire) of the five elements stand for the four corners of the world (with the fifth element earth symbolising the centre). Objects within the unified entity are related to the square shape: cities, houses, fields, including characters.

3) Chinese philosophy, also had its influence on the invention of characters. *Square* fits Chinese’s aesthetic values and stands for some much-appreciated virtues such as integrity, uprightness, others. The internal structure of Chinese characters is mainly formed in a vertically or horizontally symmetrical way, which reflects the ultimate Chinese philosophy of Ying and Yang. Even the imaginary middle line Chinese people use to anchor character components during writing can symbolise the doctrine of the mean.

### 4.2 Phonology and romanisation of Modern Standard Chinese

Chinese is considered to be a syllabic writing, where each Chinese character presents a syllable which consists of an initial (or onset), final (or rime) and tone. The initial is the initial consonant, whereas the final can be divided into the medial, vowel and final consonant. All syllables must have vowel and tone while the other components are optional. The pronunciation of Chinese words is transcribed in the Roman alphabet in order to facilitate learners to learn Chinese pronunciation. There have been various attempts (e.g. Yale, Wade-Giles, Gwóyù luómàzì) for Chinese phonology romanisation but none of them has achieved...
widespread use except *pinyin*. *Pīnyīn*, which was invented in the 1950s is the one officially used today in the PRC.  

4.3 Types of Chinese characters

*Shuowen jiezi*, written by Xǔ Shèn in around 100 AD, is the first book systematically analysing the structure of characters and the rules of how they are created. Around 9,500 characters are categorised in three levels. First, according to their physical structure, characters are divided into two distinctions: Wén (unit characters contain a single graphic element) and Zì (compound characters consist of more than one component). Second, Xǔ classifies characters based on 540 semantic components. Containing one of these semantic components means the character is classified under the lexicon of this component. Sometimes, one character contains more than one semantic components; only the primary semantic component would be singled out and used as the semantic classifier. Third, Xǔ categorised characters into six groups (六书, six script); four are related to character creation: pictogram, ideogram, semantic-semantic compound and semantic-phonetic compounds and two are related to the extended use of existing characters.

Pictograms (象形, xiàngxíng) are a consistent or similar way to represent particular images in the form of picture-writing symbols, such as 人 which conveys the image of a person, or 日 is used to symbolise the image of the sun; they are unit characters and likely to be the earliest type of characters created.

Ideograms (指事, zhǐshì) are also unit characters. They might be developed on or extended from pictograms which were used to represent visible and concrete forms into representing invisible or abstract ideas, as ‘above’ and ‘below’, respectively 上，下.

Semantic-phonetic compounds (phonetic compounds for short, 形声 xíngshēng) were created by combining existing characters to a new meaning in two stages. First, the use of a character with a certain meaning was extended for a similar/same-sound character to represent a different meaning; then the semantic determinative was added to create a new character specific to this new meaning in order to avoid ambiguity. The classical example for the creation process of this type of character is 妈 (mā, ‘mother’), combining the phonetic part 马 (mǎ, ‘horse’) and the semantic component 女 (nǚ, ‘female’).

Semantic-semantic compounds (会意 huìyì) are the new characters also created by using existing characters. But in this case the use being extended is not sound but meaning. For example, 休 ‘rest’ combines 人 ‘person’ and 木 ‘wood, tree’. The meaning of rest is conveyed by a person leaning on the tree. Also, 家 ‘home’ consists of 宀 ‘roof’ and 矢 ‘pig’. Because each house has its own pigsty, pigsty is used to represent home. However, the legitimacy of most characters under this category is questioned by some modern scholars, e.g. Boltz and Rogers. These authors believe that they are actually phonetic compounds whose phonetic value is lost in the long and complicated process of phonetic changes.

Redirected characters (转注 zhuǎzhù) are different characters related etymologically. *Shuowen jiezi* provides an example of a character pair 考 kāo ‘aged’ and 老 lǎo ‘old’. It

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74 Boltz, "Early Chinese Writing", 196.
75 Ibid, 191.
76 Ibid, 33-36.
77 Ibid, 197.
seems that these two different characters have similar forms, similar sounds and same meaning.

Borrowed characters (jiǎjiè 假借), similar to redirected characters, are existing characters extending their use to represent their homophones or near-homophones. For example, 令 ling ‘command’ is borrowed as liáng 良 ‘fine’ in written.\(^79\)

By the beginning of 18\(^{th}\) century (Qing dynasty), several tens of thousands of characters had been created. A group of scholars were designated by the Kangxi Emperor to write a comprehensive dictionary: 康熙字典, ‘The Kangxi character dictionary’. It has become the standard authority to regulate and ensure the correct use of characters.\(^80\) It contains 47,000 characters, five times of the number in Shuowén jiezi. It also reduced the number of semantic classifiers from 540 to 214. These 214 semantic classifiers, now called radicals remain to be the basic and standard framework for lexicographical works.\(^81\) The most recent comprehensive character dictionary is Hanzi da zidian 汉语大字典, ‘Great Dictionary of Chinese Characters’. The first edition was completed in 1990. It includes more than 60,000 characters listed under 200 radicals.\(^82\) However, the number of characters in daily use is a much smaller number than 60,000. More specifically: “1,000 characters cover around 90\% occurrences in typical texts; 2,400 cover 99\% per cent and 3,800 cover 99.9 per cent; 5,200 cover 99.99\% per cent and 6,600 cover 99.999\%”.\(^83\) The estimated number for an average Chinese is between 2,000 to 2,500.

5. Recognising Chinese character: sign, sound, and meaning

As outlined in Section 1, the three major lexical constituents of word recognition are: orthography, phonology and meaning. The present section examines the relationship between these three lexical constituents in their corresponding smallest contrastive units in Chinese language: grapheme, syllable and morpheme. As we can see the Figure 5 and Figure 6 with the shaded grey boxes, the relationship among the sign, sound and meaning is relatively straightforward: each Chinese character is a grapheme, which presents one syllable and has one meaning. However, in rare cases, one syllable can represent more than one morpheme at a time or one morpheme is written by two or more graphemes. Moreover, grapheme, syllable and meaning can have multiple shapes in different contexts. I will elaborate explicitly on the relationships among these three lexical constituents.

5.1 Grapheme vs Syllable

Character is the smallest unit in the Chinese writing system which contrasts with other characters.\(^84\) The spoken chain is divided into syllables. Each syllable corresponds to one grapheme (character). The only exception case of one syllable written with two graphemes involves ‘nominal forms ending in the suffix <r>’ which originally meant ‘son’ or ‘child’. This diminutive suffix has been used in the Beijing dialect, hence, is adopted in Modern Standard Chinese. For example, the syllable /huār/ ‘flower’ has two graphemes in

\(^{79}\) Boltz, "Early Chinese Writing", 197.
\(^{80}\) Ibid, 198-199.
\(^{81}\) Ibid.
\(^{83}\) Mair, "Modern Chinese Writing", 200.
\(^{84}\) Ibid, 10.
writing: 花 ‘flower’, 儿 ‘SUFFIX-mente’. These single syllables represented by more than one grapheme are call polygraphs. Typical polygraphs in English are single phonemes represented by two letters, e.g. the sequence sh represents the single phoneme /ʃ/. Rogers believes that there is another exception in which case the single grapheme 十字符 to represent two syllables /èrshí/. According to the Xinhua dictionary (2015), 十 is one syllable /niàn/ in Standard Modern Chinese. 十字符 pronounced as two syllables /èrshí/ might be a phenomenon which only exists in some dialects but not in standard Chinese.

When reading a character, most commonly, one grapheme is pronounced by one syllable shape, e.g. 白 - /bái/. In a few cases, one grapheme can be pronounced by two or more syllable shapes. Those characters with multiple corresponding syllable shapes are called polyphones, e.g. 行 is a polyphone associated with the syllable shapes: /xíng/ and /háng/. One similar example of a polyphone in English is that project can be pronounced either /ˈprəˌdʒekt/ or /prəˈdʒekt/.

Very often, one syllable has one corresponding grapheme shape in the written form, e.g. /bái/ - 白. It is also very common that one syllable represents several grapheme shapes, which results in homophones. Homophones are characters with graphemic distinctions but sharing the same sound, e.g. /yī/ can be represented in writing by homophones: one —, clothes 衣. Homophones are so common in modern Chinese that they have become a ‘prominent feature’ according to Taylor and Taylor, each tone syllable (syllable with tone) corresponds to 11 characters on average. Without necessary morphemic information, confusion in the use of character would occur. Homophones also exist in English, e.g. /pe:/ can be written as pair or pear.

![Diagram](image)

**Figure 5:** From grapheme to phoneme

### 5.2 Morpheme vs Syllable

It is normal to see that a morpheme and syllable have one to one correspondents. However, the relationship between the two is more complex than that. There are both

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86 "Xīnhuá Zìdǎn" (新华字典) [Xinhua Dictionary], Edited by Institute of Linguistics Chinese Academy of Social Sciences [中国社会科学院语言研究所] (Beijing: 商务印书馆 [The Commercial Press], 2015), 714.
88 Ibid, 27.
multiple-syllable morphemes and multiple-morpheme syllables. One-syllabic morphemes consist of the great majority of cases in Chinese characters, e.g. ‘white’ - /bái/ 白. Multiple-syllable morphemes are a less common pattern. This type of multiple-syllable morpheme is often seen on animals and plants, e.g. ‘butterfly’ - /húdié/ 蝴蝶 or foreign loaned words ‘chocolate’ - /qiǎokèlì/ 巧克力. Furthermore, though it is the general rule that each syllable stands for one morpheme (e.g. /bái/ 白 - ‘white’), there is a small exception where one syllable stands for two morphemes. It relates to the diminutive suffix <r> mentioned earlier, e.g. /huār/ 花儿 and contains two morphemes: 花 ‘flower’ + 儿 suffix ‘-r’.

It is both very common to see one morpheme represented by different syllable shapes (e.g. both syllables /kàn/ and /shi/ can mean ‘see’ 看) and one syllable standing for different meanings in different contexts (e.g. syllable /yī/ can mean ‘one’ (一) or ‘clothes’ (衣) depending on context). The former characters are synonyms which are different characters sharing the same meaning and the latter characters are homophones which are different meanings sharing the same sound. Examples in English for such cases are: ‘begin’ and ‘start’ sharing the same meaning are synonyms, and ‘aunt’ and ‘ant’ sharing the same pronunciation are homophones.

Figure 6: From morpheme to phoneme

### 5.3 Grapheme vs Morpheme

The primary relationship of grapheme is to morpheme. Most commonly, one grapheme represents one morpheme, e.g. 我 ‘I’. A small proportion of single morphemes are made up of more than one character. Each character has one corresponding syllable. Therefore, they are the multiple-syllable morphemes mentioned earlier (e.g. animal ‘butterfly’ 蝴蝶 /húdié/ or borrowed words ‘chocolate’ - 巧克力 - /qiǎokèlì/). English is a graphemic writing system, any words with more than one letter can be seen as a multiple-grapheme morpheme, e.g. English, <e n g l i s h>.

Very often one grapheme has one meaning, e.g. 我 ‘I’. There are also abundant examples of one grapheme representing many morphemes in different situations. It falls into another category of homonym which are characters with the same written form but having more than one meaning, e.g. 行 represents ‘work’, ‘conduct’, ‘row’, ‘profession’, etc.

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92 Ibid, 28.
Similar cases in English would be that <I> means ‘myself’ and <book> means ‘printed pages’ or ‘preserve’. According to the general rule, each morpheme is represented by one grapheme ‘I’ - 我. There is also a typical pattern that one morpheme can be represented by different graphemes, e.g. ‘see’ can be written as 视 or 看.

![Diagram](image)

Figure 7: From grapheme to morpheme

6. Conclusions

In conclusion to this survey on the main typological features of the Chinese writing system, one main crucial aspect can be highlighted. In the decoding processing, due to the huge number of homophone syllables corresponding to different graphemes in different contexts, for a successful orthographic decoding, the morphemic information is needed. A phonological mediation theory is therefore consistent with the structural features of the Chinese writing system, and with its relation to the represented utterance. More studies need to be conducted, to test the extent of this type of WR, possibly resorting to a comparison between semantic and phonological priming. At this stage, it can be said that, just as alphabetic languages are decoded also resorting to a grapheme-to-meaning path (which resembles ideographic processing), in a similar but specular way, Chinese is more effectively decoded via a phonological mediation (typically conceived to be a more “natural” method for alphabetic languages). It could be said that, whatever writing system is being used (alphabetic or logographic), in both cases the reader needs to resort to a twofold route. The choice might depend on the level of proficiency, and on other variables that need to be identified and investigated. In all cases, the grapheme-to-meaning direct access to the lexicon and the phonological mediation process are not mutually exclusive paths, and can be used in combination to trigger a more effective character acquisition in Chinese L2.
References


