# Mnemonic Networks: Multiple Paths to Learning Sino-Japanese Characters

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## ABSTRACT

*The primary impediment to literacy in Japanese is kanji proficiency. The ostensible reason kanji present such a formidable challenge, especially for the second language learner, is the combined effect of their quantity and complexity. Research into the cognitive processing of logographic characters, however, indicates that the main obstacle to kanji acquisition is the opaque relation between graphemes and phonemes. A pedagogical focus on establishing links between form and meaning at the expense of pronunciation, therefore, puts the L2 learner at a distinct disadvantage, thereby reinforcing the belief that Japanese is a difficult language to master. What is needed, instead, is an approach that foregrounds grapheme-phoneme correspondences while establishing meaningful links to orthographic representations. Due to their pictographic pedigree, kanji readily lend themselves to the use of mnemonic aids as witnessed by their inclusion in most textbooks and study guides. A review of these learning materials reveals a general misapprehension of such memory-enhancing techniques. In contrast, the method introduced herein is an attempt to bring much-needed clarity to the kanji learning process while abiding by mnemonic principles.*

## INTRODUCTION

A common perception among learners of Japanese is that it is a difficult language to master due primarily to the intricacies of its writing system. In addition to employing two phonetic syllabaries (hiragana and katakana), Japanese words are rendered in the logographs known as kanji. Whereas hiragana and katakana can be learned rather quickly, the same cannot be said for kanji, whose number and complexity are usually cited as the reasons they represent such a considerable challenge, especially for those whose linguistic environment is bereft of Chinese characters. On an ease-of-learning scale developed for diplomats by the US Department of State, Japanese is ranked as the most difficult language for English speakers to acquire. This should come as no surprise given the fact that native speakers need at least nine years to achieve functional literacy. A further impediment is the interference that occurs from first language acquisition practices that expect, for instance, clear links between sounds, symbols, and semantics. Not only second language learners, but most researchers and practitioners also share the assumption that learning to read and write Japanese is a significant burden for both natives and non-natives (e.g., Matsumoto, 2013; Rose &

Harbon, 2013; Shimizu & Green, 2002; Tamaoka, 2014; Tamaoka & Yamada, 2000; Toyoda, 2007; Toyoda & McNamara, 2011).

The initial goal here is not to minimize but to clarify the nature of the purported difficulty that kanji present to the second language learner. Only then will it be possible to design effective methods that address this challenge. It will be shown that quantity and complexity are misleading beliefs that help induce poor learning outcomes. Kanji pedagogy ought to proceed from a recognition that the main obstacle to acquisition is opacity, which is best addressed by attending to the weakest link in the reading/ writing process, namely, the general lack of correspondence between graphemes and phonemes. It is here where the second language learner is most prone to error. Associations between character and meaning must likewise be clarified before attempting to connect the phonological, orthographic, and semantic aspects of each character. Establishing such a cognitive network with the learner at the center is best achieved by utilizing mnemonic principles, such as elaboration, association, and imagination. A method that seeks to provide much needed transparency to the entire learning process is thus introduced that takes these considerations into account.

This paper thus begins with a concise discussion of the confounded nature of kanji and how they differ from other orthographic symbols. A review of the relevant literature suggests the need for designing effective methods that address the fundamental disconnect between orthographic symbols and phonological representations, which is the primary obstacle for second language learners, particularly at the initial stages of reading proficiency. Teaching materials that claim to lessen the burden of learning kanji often make use of memory-enhancing techniques, which, from a mnemonic perspective, reveal a fundamental misappropriation. In contrast, a mnemonic network method to mastering kanji is then introduced by way of extended example. An outline of the learning sequence that highlights the pedagogical principles involved in this method forms the final section of this paper.

## THE CONFOUNDED NATURE OF KANJI

When compared to say, 33 letters in Russian, or 28 letters in Arabic, the thousands of Japanese characters that must be learned appear to represent a considerable obstacle to literacy. Letters and characters differ, however, in several important respects. Letters carry phonetic information; specifically, they are phonemic units. Correspondences between graphemes and phonemes are usually transparent. Kanji, by contrast, represent syllables (or consonant-vowel combinations known as mora) and morphemes. Due to their multiple readings, phonetic activation depends on either lexical or sentential context. For a character appearing alone, only a potential list of pronunciations can be made. An apt example is the orthographically simple character [上] which has seven distinct pronunciations not counting various inflections that are rendered in hiragana. The correct pronunciation is determined once the character is written alongside others as part of a word or in a sentence (see Kondo-Brown, 2006). Kanji opacity is also the result of phonetic components (or radicals) that are often an inaccurate guide to pronunciation (Mori, 2014).

Prima facie evidence suggests that connections between form and meaning ought to be more consistent given the frequency of so-called radicals that carry semantic value. The radical that indicates "ice" [冫] would seem to have little relation to the character [次] which means "next." But this is an exception, for most radicals

point toward the semantic essence of the kanji in which they appear. Similar observations can be made concerning polysemy. While there are characters with divergent denotations—the character [弁], for instance, can be rendered as "discriminate," "speech," "petal," "valve," "explain," or "dispose," the majority attains a core or central meaning that is further reinforced through frequency of usage. Like morphemes in English, compounds (i.e., words comprised of two or more kanji) can be readily deduced from their parts (see Shibatani, 1990). Sometimes, however, due to convoluted etymologies or phonetic borrowings, understanding them requires some creative effort or cultural insight. The word for freedom [自由], literally "self" [自] plus "reason" [由], is a case in point. Learning is facilitated nonetheless when there is a close association between the visual shape of a character and its meaning (Kuwabara, 2000; Soemer & Schwan, 2012; Yamashita & Maru, 2000).

Orthography, as well, certainly distinguishes kanji from letters. For those unfamiliar with Chinese characters, they tend to appear as an abstract combination of meaningless lines or strokes, which number from one to thirty. A related point is that there is little to no correspondence between the stroke patterns and pre-existing perceptual knowledge in the learner's long-term memory. It might be helpful, therefore, to think of the strokes of each character in terms of letters, a certain number of which constitute words. The greater the number of strokes, the more complex the character, and like words in English, the longer they are, the more parts (i.e., morphemes) into which they can be divided. When one considers that the typical kanji contains about twice as many strokes as the average number of letters in an English word, breaking down the more complex characters into their most significant parts through a process of componential analysis is viewed as an efficient means of bringing some familiarity to recurrent patterns (e.g., Kubota & Toyoda, 2001; Toyoda, 2007).

Once a character is attached to a core concept and broken down into its meaningful constituents, phonological opacity is still the primary obstacle for the second language learner. Even if one were able to bring some transparency to phoneme-grapheme relationships, the large number of kanji to be learned remains. At present, there are 2,136 everyday use (or *jooyoo*) kanji that must be mastered to achieve basic literacy. This number pales into insignificance, however, when one likens kanji not to letters, but to words or word parts. As Mori (2012) observes, learning a few thousand is not an unreasonable number if the goal is advanced-level study. To put this in perspective, the average American high school student knows about 12,000 words. Indeed, given their lexical fecundity as well as an ability to attain both semantic and phonetic value, characters might actually constitute a more efficient orthographic system than those that are letter based.

To reiterate, kanji pose a difficulty not because of their quantity and intricacy but mostly due to the lack of transparency between their symbolic forms and oral expression. This is especially the case for second language learners who approach the task with a rudimentary knowledge of the spoken language. The same cannot be said of semantic-orthographic correspondences, which are often aided by radicals, whose identification, in turn, assist in a character's visual recognition (see Tamaoka & Kiyama, 2013). What is required, then, is a way of making the stroke patterns meaningful and distinctive in the process of becoming phonetically familiar. Research concerning the cognitive processing of logographic scripts and second language acquisition lends further support for pursuing such an approach.

**PEDAGOGICAL IMPLICATIONS OF PSYCHOLINGUISTIC RESEARCH**

The major question for psycholinguists studying the lexical processing of Chinese readers over the past few decades has been whether there is a direct link between orthographic information and semantic representation, or like alphabetic languages, meaning depends on phonological activation. While this debate continues, there is, according to Zhou, Ye, Cheung, and Chen (2009), a consensus that orthography and phonology operate interactively in a manner that influences semantic processing of Chinese (Francis, 2010; Perfetti, Liu, & Tan, 2005; Perfetti & Zhang, 1991, 1995; Tan, Hoosain, & Siok, 1996; Tan & Perfetti, 1998; Xu, Pollatsek, & Potter, 1999; Zhang, Perfetti, & Yang, 1999). Specifically, this involves mapping sound units to written symbols in order to facilitate lexical retrieval, which is critical during the early stages of reading development (Chow, McBride-Chang, & Burgess, 2005; Zhang, Li, Dong, Xu, & Sholar, 2016). Severing the link between phonology and orthography, as is done in second-language teaching methods that ignore pronunciation, would appear to have negative implications for effective acquisition. A related question concerns the degree to which sub-lexical processing of radicals affects character recognition (e.g., Flores d'Arcais, Saito, & Kawakami, 1995; Zhou & Marslen-Wilson, 1999). While both semantic and phonetic radicals facilitate accurate comprehension, it is the semantic path to retrieval that seems to be more important when decoding a character (Feldman & Siok, 1999; Ho, Ng, & Ng, 2003; Shu, McBride-Chang, Wu, & Liu, 2006; Williams, 2013; Yeung et al., 2011; Zhang, Li, Dong, Xu, & Sholar, 2016). Moreover, semantic radicals that are unrelated to a character's meaning serve to inhibit effective recognition (Toyoda & McNamara, 2011; Williams & Bever, 2010). A pedagogical imperative, therefore, is to make all components of a character meaningful, so they can act as semantic indicators (e.g., Feldman & Siok, 1997).

Studies that ask people to "read" isolated characters or lists of kanji usually find evidence of orthographic to semantic processing, that is, from text to meaning, or parallel processing with the character eliciting either a phonetic or semantic response (Sakuma, Sasanuma, Tatsumi, & Masaki, 1998; Wydell, Patterson, & Humphreys, 1993). These experiments do not simulate reading, however, but are indicative of what occurs when attempting to identify an individual character (e.g., Flores d'Arcais, Saito, & Kawakami, 1995; Kayamoto, Yamada, & Takashima, 1998; Shimamura, 1987). Because kanji normally appear as part of compounds, phrases, or sentences, without which they cannot be decoded meaningfully (Morita & Tamaoka, 2002), their pronunciation is clearly determined by the context. As a result, when asked to decode compounds, phonological activity is automatic, and, according to Morita and Matsuda (2000), inevitable at a subconscious level (see also Sakuma, Sasanuma, Tatsumi, & Masaki, 1998). Likewise, when tested at the sentential or discursive level, subvocalization occurs, as it must, otherwise the reading process will be so slow as to overload short-term memory with too much orthographic and semantic information (Koda, 1992; Tzeng, Hung, & Wang, 1977). Matsunaga (1996) holds that subvocalization is what fluent readers do under normal conditions (cf. Erickson, Mattingly, & Turvey, 1977; Kinoshita, 1998). Not only do Japanese children access the phonetic code prior to the semantic code when reading (Flaherty, 1991; Leong & Tamaoka, 1995), but adults also appear to depend on phonetic cues when decoding kanji (Flaherty & Moran, 1999; Matsunaga & Crosby, 1997; Saito, Masuda, & Kawakami, 1998; Wydell, Patterson, & Humphreys, 1993).

Second-language learners at all levels of proficiency rely on phonetic information for effective kanji comprehension (Flaherty, 1991; Kondo-Brown, 2006;

Machida, 2001; Mori, 1998), apparently due to a transfer of cognitive reading processes from their native tongue (see Akamatsu, 2005; Chikamatsu, 1996; Koda, 1989). Even in the case of native speakers of Chinese, reading kanji appears to activate the Chinese pronunciation of the same characters (Kayamoto, 2000). If sound activation is, in fact, automatic, necessary for the proper functioning of working memory, and requisite to subsequent lexical retrieval, then the pronunciation of words needs to be learned before attempting to read, particularly in the case of kanji whose grapheme-phoneme correspondences are mostly opaque (Koda, 2007; Mori, 2012). But sounds must also be meaningful, and for the novice L2 learner, this entails making use of first language knowledge. When kanji learning methods begin by connecting character to meaning without addressing its pronunciation, what occurs, in effect, is that the character is connected to a meaningful sound in the L1. This impedes the entire reading process insofar as fluency depends on not only proper sound-symbol coding at the character level, but also the ability to distinguish between homophones at the word level. Therefore, the first step is to attach a meaningful label from the L1 to the appropriate sound—namely, a character's primary *on* reading.

While seeming to understand the importance of correct pronunciation, learner strategies tend to place an emphasis on understanding the form of kanji rather than their sound (Okita, 1995, 1997). This is particularly true of alphabet background learners who are apt to use more visual strategies that underscore the semantic aspect of kanji (Flaherty, 1991; Gamage, 2003; Toyoda, 2009). Evidence for this is also found for non-native learners of Chinese (Hayes, 1988; Liu, Wang, & Perfetti, 2007; Wang, Perfetti, & Liu, 2003). Tollini (1994) argues that such an emphasis, particularly at the early stages, facilitates their distinguishability and, as a result, ought to be encouraged. This approach would seem to contravene evidence that phonological processing invariably mediates between orthographic and semantic correspondences, and, therefore, students must be given a foundation in the spoken language before being introduced to Chinese characters (Backhouse, 1993; Hayes, 1988; Shimizu, 1997). If this entails learning a non-authentic script, however, such as pinyin in Chinese, or hiragana in Japanese, in place of kanji, then reading development might be hindered (Kim, 2012; Koda, 1992).

Mastering the Japanese writing system clearly presents formidable obstacles for the second language learner. In consequence, learners need to be made aware of a wide range of strategies besides rote rehearsal, even though it is the preferred method for natives and non-natives (Flaherty, 1991; Gamage, 2003; Mori, 2012; Mori & Shimizu, 2007). Those who view kanji favorably, as a means of achieving cultural understanding, for example, tend to use mnemonic and context dependent approaches (Shimizu & Green, 2002). Imagery mediation strategy, linking form and meaning through images, has also been found to be effective, especially at the introductory level (Kuwabara, 2000; Manalo, Mizutani, & Trafford, 2004). Likewise, componential analysis whereby kanji are broken down into meaningful units whose relations are then creatively highlighted is a more efficient method than attempting to learn primarily through rote rehearsal and repetition (Flaherty & Noguchi, 1998; Kubota & Toyoda, 2001). This would necessitate a twofold focus on teaching simpler kanji and the radicals of more complex characters in a sequential manner (cf. Chikamatsu, 2005; Toyoda, 2007). Kanji with the same radicals, moreover, should be taught together in order to facilitate relational processing (Tollini, 1994; Williams & Bever, 2010). The key to devising an effective approach to learning Japanese as a second language, then, is not so much eclecticism as appropriateness (cf. Everson, 2011; Herrmann, 1987; Mori & Nagy, 1999). Before introducing a novel method that

expands upon these ideas, a brief review of the approaches found in a range of popular textbooks is undertaken.

## A MISAPPREHENSION OF MNEMONIC PRINCIPLES

The present range of kanji textbooks for second language learners correlates not only with varying degrees of understanding concerning their confounded nature, and the somewhat opaque connections between orthographic, semantic, and phonological processes, but also an apparent misapprehension of mnemonic principles. While kanji course books and learner guides evince an array of pedagogical approaches, the tendency is to focus on orthography either through componential analysis, which rests on identifying radicals or the primary elements of characters, or by utilizing various mnemonic aids. The use of mnemonics is limited to forging connections between the orthographic and semantic properties of characters with phonetics deemed a secondary concern. Learning the pronunciation of kanji is to be addressed separately, presumably through rote learning or direct experience with the characters. Not only does this indicate a lack of appreciation for the intimate interrelations between a character's form, meaning, and sound, but also a misappropriation of mnemonic techniques. If memorization of thousands of characters in order to achieve native-like fluency is the primary goal, then an approach that respects how mnemonic principles, such as association, elaboration, and organization, facilitate learning because they support specific memory processes ought to be followed. In other words, kanji pedagogy should draw upon both cognitive advances in human memory and best practices in applied linguistics while acknowledging the disparate aspects of the first and second languages involved.

The success of any mnemonic depends on what occurs when new information is first encountered. Invariably, a character is introduced by highlighting its orthographic features, that is, its stroke count, stroke order, and components, along with its meaning, pronunciation, and sample compounds or sentences. Most texts also provide a mnemonic hint or suggestion in visual and/ or narrative form that attempts to link a character's shape to its meaning (e.g., Banno, Ikeda, Shinagawa, Tajima, & Tokashiki, 2009; Kluemper, 2015; Rowley, 1992; Seeley & Henshall, 2016; Walsh, 2009). The learner is expected to first read through all this information before applying it in various exercises or practices. Along the way, the learner is admonished to study mainly through repetition and rote memorization (e.g., Grant, 2013; Millen, 2010). From a mnemonic perspective, the problem here is manifold: first, it is not clear what is to be the focus of attention, the lack of which is usually related to poor encoding (Foster, 2009; Kellogg, Cocklin, & Bourne, 1982), nor is it specified how new information should be cognitively processed (see Bellezza, 1981). If new information is to be encoded effectively, then there must be an orientation toward meaning rather than the perceptual features of the characters (Worthen & Hunt, 2011). Moreover, simply paying attention is insufficient; what is crucial, though, is the qualitative nature of the processing operations (Brown & Craik, 2000). Because lexical items are stored in speech form, particularly during the short-term stage, phonology must be addressed during the encoding process. Finally, the inherent flaw in textbooks that provide an interpretation of the characters is that they are, in fact, someone else's (usually the author's or another expert), when what is needed, if cues established at the time of encoding are to facilitate accurate retention, is for the learner to form mental associations of the characters based on his or her prior

knowledge, so that the encoding context can be reinstated at the time of recall (Moscovitch & Craik, 1976; Mäntylä, 1986; Verhaeghen, Palfai, & Johnson, 2006). In effect, it is not the input at the time of encoding that influences retrieval, but the way in which that input is internalized that becomes part of the memory trace. The more active the learner is when processing new input, the more attention it receives through repetition, analysis, or elaboration, all of which become part of the encoding experience.

Regardless of the method employed, an initial focus on acquiring the meaning of kanji not only divorces their phonetic and semantic aspects, which are known to be closely correlated, but also necessitates a two-step approach that increases the overall time to master them (e.g., Conning, 2013; Heisig, 2007). As already discussed, learners whose first language is based on alphabets that rely on phoneme-grapheme correspondence are thus impaired when phonetic information is not available. This further impedes the reading process, which depends on access to a phonological code during short-term memory so that deeper levels of processing can occur. Moreover, it puts the non-native at a distinct disadvantage vis-à-vis the native learner who already knows the pronunciation and meaning of many kanji before studying their orthography. The non-native is also unable to proceed to a more advanced level of study that requires forming compounds and the ability to look up new words in a dictionary—neither of which is possible without knowledge of their pronunciation, particularly their *on* reading. Therefore, the method described below, hereafter known as a mnemonic network, begins by linking a character's *on* reading(s) to a core concept in the L1 in order to build upon the learner's prior knowledge. The *on* reading is key due to the fact that most Japanese words are kanji compounds (Shibatani, 1990), whose characters need to be distinguished, especially when inputting text on a computer (Matsumoto-Start, 2003). The *kun* reading(s) must still be acquired, but they can now be easily referenced through their *on* reading(s) in a kanji dictionary.

## MULTIPLE PATHS OF A MNEMONIC NETWORK

In a mnemonic network, a character is introduced by establishing a meaningful link between a core concept in the learner's first language (in this case, English) and its pronunciation in Japanese. This can be achieved by creating an acronym whose first letters indicate a character's pronunciation and provide a semantic clue. To illustrate, [日] based on a pictograph of the sun also denotes "day." The acronym NIght CHases It imparts its *on* reading (NICHI) while suggesting its semantic essence. In the process of deciphering such clues, the learner must concentrate not on form but on meaning while also acquiring pronunciation. Whereas the typical acronym represents a phonemic unit devoid of meaning, and has thus been found to be ineffective in enhancing memory (Boltwood & Blick, 1970; Carlson, Zimmer, & Glover, 1981; Kibler & Blick, 1972; Morris & Cook, 1978; Perewiznyk & Blick, 1978), the acronym-anchors in a mnemonic network not only represent a reading for the character (there are often several) but also indicate its meaning. They thus form a semantic-phonetic link that, once associated with a specific character, establishes an orthographic bond to the memory trace (cf. Higbee, 2001). Because they can easily be embellished with interactive imagery (Stalder, 2005), the acronyms encourage distinctive processing which appears to facilitate learner motivation and retention (Bloom & Lamkin, 2006; Gibson, 2009). The acronym-anchors in a mnemonic network also chunk information in a meaningful way that provides

transfer-appropriate cues for retrieval (Nelson & Archer, 1972; Tulving & Thomson, 1973). Given that foreign language vocabulary are not learned in isolation, lessons can introduce a list of related words in the form of a crossword puzzle, the clues of which are the words that comprise the acronyms and the solutions the meanings of the target words.

Before proceeding to study kanji orthography, character pronunciation needs to be reinforced. One way to do this is by reversing the process in the first step. That is, the learner is provided with the core concept and the first letters of the clue and must complete, in the manner of an acrostic, the words that comprise it. For the character [日] that denotes sun or day, the acrostic is:

| N | I |   |   |   |   |
|---|---|---|---|---|---|
| C | H |   |   |   |   |
| I |   |   |   |   |   |

Completion of fragmented words, whether involving conscious awareness at the time of remembering, or learned without conscious recollection, is generally faster or more certain for those recently encountered than for new ones (Foster, 2009). Acrostics are like word fragments, whose priming function facilitates their completion. More importantly, working on acrostics compels the learner to process their meaning to a greater degree or depth, which enhances memory (Brown & Craik, 2000). In this case, they reinforce the semantic-phonologic associations introduced in the acronym, which helps to avoid interference or confusion between the many homonyms in Japanese. Helping to make each pronunciation distinct in the memory, moreover, produces unique cues that tend to increase recall dramatically (Mäntylä & Nilsson, 1988).

The learner is now ready to commence study of kanji orthography much in the same way that a Japanese child approaches them, that is, with a rudimentary knowledge of their pronunciation and meaning. One way of making the abstract unfamiliar shapes meaningful and distinctive in the process of becoming familiar is by transforming them into recognizable pictures through a process of componential analysis (see Henshall, 1998). In this way, the elements of each character are akin to the to-be-remembered items in the method-of-loci—the ancient mnemonic practice of using images from known locales to help recall new information (see Yates, 1966). Instead of a using a familiar place or street, each kanji character occupies an imaginary box within which the various elements are arranged. Because a majority of characters are compounds comprised of more than one element (Tamaoka, Kirsner, Yanase, Miyaoka, & Kawakami, 2002), componential analysis initiates identification and integration of unfamiliar parts into a coherent pattern or whole by assigning significance to each, thereby establishing visual associations between a character and its meaning (cf. Kuwabara, 2001). To continue with the previous example, [日] is a component that is depicted in various ways, such as:

旦 (dawn)　　=　　日 (sun)　　+　　一 (one)
東 (east)　　=　　木 (tree)　　+　　日 (sun)
明 (bright)　　=　　日 (sun)　　+　　月 (moon)

In fact, componential analysis appears to be a normal part of character identification for native Chinese readers (Ding, Peng, & Taft, 2004; Feldman & Siok, 1997; Taft & Zhu, 1997; Zhou & Marslen-Wilson, 1999). Explicit teaching of radicals or phonetics

has also been found to facilitate character comprehension for both children (Ho, Ng, & Ng, 2003; Ho, Wong, & Chan, 1999; Shu & Anderson, 1997) and adults (Wang, Liu, & Perfetti, 2004).

Rather than rely on a holistic approach to character acquisition, which tends to make use of rote repetition, Taft and Chung (1999) argue that radicals ought to be taught from the beginning of reading instruction (see also Williams & Bever, 2010). Recognition of a radical that is a character itself, especially when it is of semantic value and appears in the same position, facilitates the reading of compound characters (i.e., those containing more than one radical) even for native readers of Chinese (Feldman & Siok, 1997). There is also a close correlation between sublexical processing of phonetic radicals and the understanding of simple and complex characters in Chinese even though their meanings are unrelated (Zhou & Marslen-Wilson, 1999). This suggests that students must learn orthographically simpler characters, particularly radicals, before more complex ones because recognition of the latter depends on knowing the former (Okita, 1997; Wang, Liu, & Perfetti, 2004). It also indicates that the processing of characters is hierarchical proceeding from strokes to radicals, which occupy the base for both simple (one component) and compound (two or more component) characters (Ding, Peng, & Taft, 2004).

In a mnemonic network, therefore, the ordering of kanji is not determined according to frequency rankings (Nishiguchi & Kono, 1994), proficiency test requirements (Banno, Ikeda, Shinagawa, Tajima, & Tokashiki, 2009; Millen, 2010), or the Japanese Ministry of Education, Culture, Sports, Science and Technology's conventions for schoolchildren (Henshall, 1998). Instead, characters are arranged logically from simple to complex and grouped together according to their most meaningful elements in order to enhance simultaneous encoding of both similar and dissimilar features of each character, thereby facilitating their retrieval (cf. Hunt & McDaniel, 1993; Lu, Webb, Krus, & Fox, 1999). Once a character is learned, it retains the same meaning when it appears as an element in other characters (cf. Conning, 2013; Heisig, 2007; Henshall, 1998). The meanings ascribed to the various elements must also be consistently applied in order to reduce any unnecessary burden on the memory. So rather than divide the following character [担] into three parts (扌日一), it is remembered as two:

担 (bear)　　=　　扌 (hand)　　+　　旦 (dawn)

As evidenced by its inclusion in virtually all kanji textbooks for both native and non-natives, most agree that kanji writing practice facilitates their understanding. Although writing Chinese characters is time consuming, it should be done deliberately (Cao et al., 2013; Tan, Spinks, Eden, Perfetti, & Siok, 2005). This is due to the fact that they tend to be morphologically complex and their rendering demand attention to detail as well as the internal balance of their elements (e.g., Hatta, Kawakami, & Tamaoka, 1998). Indeed, taking heed of such demands is requisite to turning the handwritten expression of kanji into the art form of calligraphy. As Naka and Naoi (1995) demonstrate, simply repeating the strokes mindlessly produces small gains in recall or recognition (see also Kubota & Toyoda, 2001). On the contrary, writing practice must be accompanied by a form of elaborative rote rehearsal of their pronunciation and meaning to strengthen the respective connections between them (cf. Guan, Liu, Chan, Ye, & Perfetti, 2011). It should further include a graphic embellishment of the characters treating them as sketches in need of visual

interpretation. Reinforcing the mnemonic links between the orthographic, semantic, and phonetic elements should not only lead to better recognition and recall but also facilitate their retrieval via multiple paths (cf. Longcamp et al., 2008; McDaniel & Masson, 1985). Besides, such repeated movement, if done in a rhythmic manner, helps to calm the mind, which is a precursor to heightened concentration.

Up to this point, the learner has established associations between the meaning of a character and its pronunciation. He or she has also identified its components and assigned meaning to each of them. In order to complete the network, the next step is one of an elaborative synthesis of all the elements into a short narrative. Research has shown that asking people to make up a meaningful story that links a pair or list of words facilitates later recall (Baddeley, Vallar, & Wilson, 1987; Bobrow & Bower, 1969; Boltwood & Blick, 1970; Foster, 2009; Herrmann, Geisler, & Atkinson, 1973; Reddy & Bellezza, 1983). In this case, learners ought to treat the clue from the acronym, the core concept, and the main elements of the character as a narrative framework in need of interpretation. The story-sketch that is produced should be as short as possible while attempting to connect the words in a memorable manner (cf. Gruneberg, Monks, Sykes, & Oborne, 1974). One way to do this is through the use of vivid and interactive imagery (cf. Bower, 1970; Paivio & Desrochers, 1981), although the learner is advised to try and strike a balance between bizarre and common images (Worthen & Hunt, 2011), reserving the former for homonyms in order to make them distinct (see McDaniel & Einstein, 1986). Paivio (1979) maintains that effective interactive imagery depends on the degree to which sentences involve concrete objects, describe specific events, and are rendered in the active voice. Another effective technique is to make use of alliteration, assonance, and rhyme whenever possible or appropriate. Rhyme is a form of elaboration that induces distinctive processing. Rhyme cues are most effective when presented in combination with semantic cues as they help restrict the possible choices during retrieval (Bower & Bolton, 1969; Rubin, 1995; Rubin & Wallace, 1989). The story-sketch thus includes all the items to be remembered in a meaningful context that is characterized by strong associations between the various semantic, phonemic, and orthographic elements, thereby establishing multiple paths for recall. The following examples demonstrate the foregoing points of story construction:

| Kanji | Acronym | Core Concept(s) | Components |
|---|---|---|---|
| 日 | NIght CHases It | **sun; day** | *sun with spot* |
| Story Sketch: After a **day** of **sun**, NIght CHases It away. | | | |
| 旦 | Twinkles After Nighttime | **dawn** | sun + one |
| Story Sketch: First sunlight at **dawn** Twinkles After Nighttime. | | | |
| 担 | Troubles Assume Now | **bear, shoulder** | hand + dawn |
| Story Sketch: Troubles Assume Now to **bear** burden handed down at dawn. | | | |

Although self-generated material tends to be better remembered than other-presented material, presumably due to the heightened level of attention and cognitive effort that invariably constitutes deeper levels of processing (Bloom & Lamkin, 2006; Bobrow & Bower, 1969; Kuo & Hooper, 2004; Slamecka & Graf, 1978), devising a complex mnemonic entails considerable time and effort (Patton, D'Agaro, & Gaudette, 1991; Worthen & Hunt, 2011). It also requires training in word analysis and meaningful elaboration associated with mnemonic techniques designed to enhance second-language vocabulary recall and recognition, something many

students apparently lack (e.g., Lawson & Hogben, 1996; Shen, 2004). In this case, it is a shared exercise. The acronym is provided (cf. Kibler & Blick, 1972), but the learner must first link it to the core concept. The acrostics function in a similar manner, that is, as stimuli for self-generation (cf. Slamecka & Graf, 1978). After the components of the character are identified, the learner is required to bring them to life as it were through their visual imagination. Finally, the acronym, core concept and character components are incorporated into a story-sketch by the learner to complete the mnemonic network. In effect, the mnemonic network approach constitutes a collaborative effort that occurs at a midway point along the continuum of self- and other-generation.

As indicated earlier, kanji do not normally appear in isolation but, due to their polysemic and polyphonic nature, are joined with others to form compounds. Most texts provide the learner with two-character compounds in addition to sample sentences so that they can be understood in a meaningful context (e.g., Millen, 2010; Nishiguchi & Kono, 1994). Little guidance is given as to how to remember these compounds other than by memorizing them presumably through repeated exposure or intensive study (Sakade, 2003). In keeping with the interactive nature of the approach established thus far, reading practice begins by placing a recurring element (or component) at the center of an empty box. Learners are then asked to complete the character with assistance of a phonetic clue. The same process is repeated with two-character compounds wherein, instead of a component, one of the characters is provided. Reading practice concludes with sentence completion exercises in which learners are given semantic and phonetic clues. Hence, a representative character cluster includes:

1. Complete the character using the clues.

| 日 | (MEI) Moon Emits Illumination |
|---|---|

2. Compose the compound using the clues.
   (BUN) 文　　　+　　　(MEI) _____　　=　　　_____ (civilization)
   **writing**

3. Complete the sentence using the clues.
   その答えをもう一度説＿＿してください。
   Sono kotae o moo ichido setsuMEI shite kudasai.
   Please explain that answer once again.

It is at this point in the learning process that the student is advised to rest before commencing study of the next group of new characters. Assuming that each learning sequence consists of about twenty kanji, then every five weeks reading and writing should be evaluated. This evaluation builds upon the test-like conditions associated with the acrostics in step two and the character clusters in step six. There are significant benefits to spacing study in a manner that persists over substantial retention intervals (Bahrick, 2000; Pashler, Rohrer, Cepeda, & Carpenter, 2007). Bahrick and Phelps (1987), for example, found that students trained with a 30-day interval recall more vocabulary eight years later than those using shorter intervals (cf. Bahrick, Bahrick, Bahrick, & Bahrick, 1993). The same seems to be true of periodic testing which facilitates long-term retention (Roediger & Karpicke, 2006). In fact, the

type of study schedule being implemented here, which involves successive repetitions separated by intervals of increasing duration, appears to optimize retention, especially over long time periods (Gerbier, Toppino, & Koening, 2015). The five-week review is sequenced, therefore, so that it builds upon prior knowledge while instilling confidence. To the extent possible, each review should recycle kanji from previous lessons. Rest is thus supplemented with periodic rehearsals in a manner that allows the mnemonic network method to gradually yield results.

## CONCLUSION

The earliest Chinese characters were pictorial depictions intended to facilitate intergenerational memory and communication. As these mnemonic aids began to proliferate—their usage extending from the esoteric to the quotidian, a process of standardization commenced with the ostensible goal of making them easier to learn. Whatever the pragmatic gains, something clearly has been lost in the aesthetic realm as the characters have become more stylized and simplified. The abstract and indistinct rendering of their current forms stands in clear contrast to their pictographic progenitors. Teaching methods that have arisen to address these pivotal concerns of the second-language learner, in particular, tend to focus on the shape of kanji presuming a one-to-one correspondence between orthography and semantics. Findings in both second-language acquisition and human memory research, however, clearly indicate the central role of phonology in the reading/ writing process, which is the guiding assumption of the mnemonic network method described herein. The method has also been designed to mimic a native learner's approach insofar as it provides the non-native with a rudimentary knowledge of kanji meaning and pronunciation before attempting to master their orthography. Finally, this method seeks to establish multiple paths to kanji recall by utilizing formal mnemonic principles that have been integrated into the learning sequence (see Table 1).

**Table 1. Learning Sequence for Mnemonic Network**

| Step | Principle | Focus | Activity |
| --- | --- | --- | --- |
| 1 | Attention | Meaning | Crossword Puzzle |
| 2 | Association | Pronunciation | Acrostics |
| 3 | Identification | Orthographic Symbols | Componential Analysis |
| 4 | Repetition | Orthographic Traces | Writing Practice |
| 5 | Elaboration | Interpretive Imagery | Story Sketch |
| 6 | Application | Recall and Recognition | Character Clusters |
| 7 | Evaluation | Understanding | Rest and Review |

The importance of attention at the time of initial exposure is a crucial aspect of the acquisition process. Although the characters themselves are not introduced in the first two steps, the links between meaning and pronunciation are formed by means of crossword puzzles and acrostics. Attention and association thus lead to character identification via a componential analysis that is parts critical and creative. The repetitive nature of writing practice is the next step toward strengthening the characters' traces in memory. In order to consolidate orthographic, semantic, and phonetic features into a more permanent representation, the various elements are integrated into a succinct and suggestive story. Elaboration of this kind is meant to facilitate recall, which is subsequently reinforced through reading application that

makes use of collocations and context. Periodic testing is suggested as the last step in the sequence as a way to evaluate what has been learned and identify what may need further review.

Given the requisites of such a course, the learner is advised not to proceed alone but employ a facilitator to assist with the learning sequence. While the overall structure of the course will be dictated, inter alia, by time constraints and learning styles, thematic organization should revolve around radicals, not frequency of usage, if fluency is the goal. Ideally, a mnemonic network will lend itself to collaboration not only between instructor and learner but also among like-minded professionals who share a passion for kanji and an appreciation for the central role that memory has in their acquisition. In this way, the learning process melds an ancient appreciation of writing symbols as vivid forms of human expression whose meaning is enhanced by their beauty with modern notions of both the potential for mnemonic principles to facilitate memory processes and the importance of learner initiative and interaction when attempting to master a foreign language.

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