Mnemonics as a Cognitive-Linguistic Network of Meaningful Relationships

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ARTICLE INFO	ABSTRACT
	Mastering a foreign language is arguably one of the most challenging memory feats. It clearly involves effective learning strategies if long-term proficiency is the goal. Outside of complete immersion in the language of study, whereby linguistic understanding is reinforced by recurrent practice, second-language acquisition depends on teaching materials that are both meaningful and memory enhancing. While mnemonic techniques have been derided for their dubious cognitive value, they find much theoretical support from the core findings of memory research concerning the importance of elaboration, association, and imagery, particularly at the time of encoding. After reviewing both the strengths and shortcomings of mnemonic devices as regards to language learning, an eclectic method is introduced that draws upon cognitive advances in human memory and best practices in applied linguistics with an eye toward its potential application in the study of a second language.

1. Introduction: The Dynamic Memory Model

We forget to remember. Therein lies both the dialectical relationship between the two, and the primary way of understanding how the memory functions. It was Ebbinghaus (1885/1964) who first noted the importance of these factors when he observed the inverse relationship between time and forgetting. While much is lost soon after it has been learned, the rate of forgetting gradually decreases as memories apparently consolidate over time (Wickelgren, 1977). The fact that information once committed to memory can be recalled faster than what has never been learned suggests that traces remain even though they may not be readily accessible (see Tulving & Pearlstone, 1966). In order to facilitate memory processes, initial exposure to new material must be encoded in a way that is meaningful (Bartlett, 1932). Atkinson and Shiffrin (1968) explain this in terms of a three-stage model of memory processing that begins with sensory stimuli that are both brief in duration and rich in content. That which is attended to is

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transferred or copied into the short-term memory, whose limited capacity entails further cognitive processing, such as rehearsal, before it can proceed to long-term memory, whose capacity and duration is virtually unlimited (see Bahrick, 1984). The encoded information that finds a place in the relatively permanent long-term store can later be retrieved through various search strategies.

The key to long-term retention, then, is the type of processing that occurs when encoding. In order to clarify the storage capacities associated with the three memory stages (sensory, short-term, and long-term), Craik and Lockhart (1972) propose a levels of processing model that functions according to a continuum of analytic attention. Specifically, depth of processing is associated with the degree of semantic elaboration at encoding that enhances retrieval by providing more cues. It is not necessarily the length of time an item is in the short-term store or the attention it receives that affects its chance of being transferred to the long-term store, therefore, but the type of processing it undergoes, with semantic processing leading to the best retention (Craik & Tulving, 1975; Craik & Watkins, 1973). Successful retrieval from the long-term store depends on the similarity or correspondence between what is encoded and how it is recalled. That is to say, the cues involved in both processes must be the same (Tulving & Thomson, 1973). Recall is further enhanced by the degree to which encodings are semantically discriminable (Moscovitch & Craik, 1976). To recall something whether aided or unaided by cues is contrasted with identifying some prior event or information when it is presented again, or what is known as recognition.

In addition to elaborating on the to-be-remembered items by embellishing them with additional features, focusing on their semantic, phonemic, or orthographic aspects, or transforming them into a different form (e.g., by reduction) are effective ways of encoding new information (Worthen & Hunt, 2011). Other ways to improve memory involve either association with familiar images, places, or items, or organization of material according to numerical or categorical rules (Higbee, 2001; Paivio, 1979). What all such memory aids have in common is that they forge connections in the mind, usually with pre-existing knowledge, or they enable certain schema to provide a framework, or cluster of relations, within which new information is understood (Rumelhart & Ortony, 1977). Finally, it is not only the type of encoding that enables effective storage to occur, but also the repeated practice or retrieval over spaced time intervals that strengthen the memory (Bahrick, 2000; Brown & Craik, 2000).

The processing of new information into a memorable code or trace thus entails cognitive effort. The active manipulation of information that is temporarily held in the short-term store occurs within the working memory, which consists of three integrated components: the phonological loop, visuospatial sketchpad, and episodic buffer (Baddeley, Gathercole, & Papagno, 1998). The phonological loop is of critical importance to language learning because it is involved in subvocal rehearsal and storage of auditory information (Papagno & Vallar, 1992). When presented with unfamiliar linguistic forms, the phonological loop provides temporary storage as they are being vocalized so that more permanent representations can be constructed. This is apparently due to the predilection for acoustic coding in short-term memory and semantic encoding in long-term memory (Baddeley, 2000). It therefore mediates long-term learning, especially unfamiliar vocabulary from a foreign language (Ellis & Beaton, 1993; Masoura & Gathercole, 1999; Papagno, Valentine, & Baddeley, 1991; Service & Kohonen, 1995).

In sum, memory is not a static entity or distinct neurological capacity but an active process that entails encoding, storage, and retrieval of sensory stimuli. Forgetting is a normal and necessary aspect of remembering due to innate limits at each stage of this process. The main factors in forgetting are a lack of attention at the time of encoding, failure to make meaningful connections when new information is placed in short-term storage, and interference and cue dependency during retrieval. Mnemonics attempts to address these shortcomings by enhancing encoding through elaboration and organization of new material, reducing the working memory load by bundling together disparate items, and minimizing dependence on long-term storage and retrieval. In the following section, the key features of formal mnemonic systems are reviewed with an eye toward their potential applicability in facilitating second language learning.

2. Formal Mnemonic Techniques

Mnemonics is ultimately about how the improvement of memory enables more efficient learning, something of great importance for those attempting to master a foreign language. All of the established mnemonic methods make use of association, organization, elaboration, and imagination in order to facilitate encoding, which, in turn, affects both storage and retrieval (Worthen & Hunt, 2011). They are also linear in their applications proceeding from the device to the information to be remembered. The method of loci, which is the oldest mnemonic, begins with the visualization of a familiar physical space, such as a room or street. The next step is to place the to-be-remembered items or information in particular locations within the space. By associating new material with acquired knowledge, retrieval occurs when the mind traverses the physical space, locating the target information along the way (Yates, 1966). The method of loci demonstrates not only the importance of visual stimuli but also the role of organization in facilitating memory processes. While it assists with remembering the main points or topics of a speech, for example, it does not help with learning details. It clearly has applications for learning rhetorical patterns of oral or written discourse and points toward the potential benefits of spatial analysis for complex orthographic scripts.

Like the method of loci, the peg-word technique depends on a serial progression of organization to enhance memory processes. Rather than traversing a known physical space, the learner uses numbers as an organizing principle. Based on the sound of each number, a phonetic mnemonic is created (the word sun, for instance, is used because it rhymes with the number one). The new information is then linked to the word sun, and each of the following numbers in the series, usually using an interactive image. Recall is achieved by counting the numbers in the list, which cues the peg words and the target items associated with them (Paivio, 1979). In contrast to the method of loci, Higbee (2001) notes how the peg-word system also allows for direct retrieval of information. Its emphasis on phonology and, in particular, the facilitating effects of rhymes would appear to have important implications for the study of foreign languages. By minimizing semantics, however, the peg-word system does not improve long-term recall of information.

The keyword approach, which was designed to enhance second language acquisition, is a variation on both the method of loci and the peg-word techniques. It attempts to forge a phonetic link (the keyword) between a foreign word and one from a known language by creating a provocative image that incorporates the meaning of the new word (Atkinson, 1975; Raugh & Atkinson, 1975). To illustrate, if a native English speaker were attempting to learn the Japanese word for work (*shigoto*), the keyword could be "goat." The image of a woman (she) taking a goat to work would facilitate its retrieval. While quite effective in this instance, there are several limitations with this technique. Finding phonetic similarity between English and Japanese words is not always easy and in some cases impossible. And even if the two languages were phonetically friendly, retrieval must always proceed through the keyword, which, more often than not, only approximates the correct pronunciation of the new word. In the case of Japanese, its plethora of homonyms creates the further disadvantage of cognitive interference when similar sounding characters become confused during recall.

The keyword method has been found, nonetheless, to facilitate the speed of acquisition and recall of second language vocabulary (Beaton, Gruneberg, Hyde, Shufflebottom, & Sykes, 2005; Bellezza, 1981; Pressley, Levin, & Delaney, 1982). This is apparently due to the enhanced links between the semantic and phonetic aspects of a target item, thereby increasing the cues available during retrieval. Like the previous two mnemonic systems, the keyword approach makes use of elaborate encoding techniques, especially interactive imagery (Paivio & Desrochers, 1981). As Wang and Thomas (1992) demonstrate, however, its effectiveness over long time intervals is not certain, which may be correlated with encoding variability, namely, whether the keyword is generated by the experimenter or subject. In the case of the former, the

rate of long-term forgetting appears to be greater for learners using the keyword mnemonic as compared to those involved in rote rehearsal even when initial acquisition levels are held constant (Wang, Thomas, & Ouellette, 1992). Actually, the long-term retention rate for both methods is poor, which suggests that when used by themselves they are of limited value (cf. Ellis & Beaton, 1993). The keyword method apparently requires repeated exposure, or the critical links in the mnemonic break down (Wang & Thomas, 1995), whereas rote rehearsal is insufficient because it lacks depth of cognitive processing.

3. Elements of a Mnemonic Network

Building upon the insights of formal mnemonic systems, the following method, hereafter known as a mnemonic network, has been developed for second language acquisition. A mnemonic network is based on certain cognitive-linguistic principles that have been shown to facilitate the learning process, that is, attention, association, and imagination. In contrast to the aforementioned mnemonic techniques, the organizing principle of a mnemonic network is semantic (see Table 1). Rather than associating to-be-remembered items with locations, as in the method of loci, or unrelated objects that comprise peg-words, target words are linked to core concepts in the learner's first language. In order to replicate native speaker acquisition, pronunciation of a word is learned along with its meaning before proceeding to reading and writing. Creating acronyms that indicate both the semantic and phonetic aspects of the target word is arguably the most effective way to accomplish this. The anchor of a mnemonic network is not a keyword, therefore, but an acronym, which encodes both the entire pronunciation of the target vocabulary word and a link (i.e., clue) to its meaning. The semantic connection is therefore not as attenuated as in the keyword approach.

Table 1. Elements of Formal Mnemonic Systems

Mnemonic	Guiding Principle	Key Features
Method of Loci	Spatial	• Items are associated with a series of locations • Assists in remembering order of main points or topics
Peg-word	Ordinal	• Items are associated with a series of concrete objects • Allows for serial or direct retrieval
Keyword	Phonological	• Item is associated with similar sounding word in first language • Serves to link semantic and phonetic aspects of target item
Network	Semantic	• Item is associated with core concept in first language • Establishes multiple paths to retrieval • Facilitates collaboration in the generation of cues

To illustrate, a native-English speaker attempting to learn the French word for door (*porte*) could use the acronym Pass On Right Through Entrance. While the first letters of the words indicate the spelling and pronunciation—the rules of which must be learned, the words themselves comprise a clue to its meaning. Requiring the learner to guess the meaning compels cognitive effort that should enhance its initial encoding given that most problems at this stage are often related to poor attention. An important issue for the native-English speaker is the gender-specific nature of French nouns. In this case, one needs to attach the definite article *la* to indicate that *porte* is feminine. This can readily be incorporated into the mnemonic network by asking the learner to link the semantic, phonetic, orthographic, and grammatical elements in the form of a vivid narrative, such as: Please use this **door** to Pass On Right Through Entrance

to the ladies room. (The ladies room is a cue to the feminine nature of door). As a result of this type of elaboration and integration, multiple associations are established, which has been found to aid in a word's recall when writing and recognition when reading (see Fig. 1).

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    ┌─────────┐        ┌─────────┐        ┌─────────┐
    │ Reading │  ◄──── │  Story  │ ────►  │ Writing │
    └─────────┘        └─────────┘        └─────────┘
        ▲              ↗         ↘             ▲
        │            ↙             ↘           │
    ┌─────────┐                        ┌─────────┐
    │ Meaning │                        │ Article │
    └─────────┘                        └─────────┘
        ▲        ↘            ↗            ▲
        │          ↘        ↙              │
    ┌─────────┐      ┌─────────┐      ┌─────────┐
    │ Semantic│ ◄──► │ Acronym │ ◄──► │ Spelling│
    │  Clue   │      └─────────┘      └─────────┘
    └─────────┘
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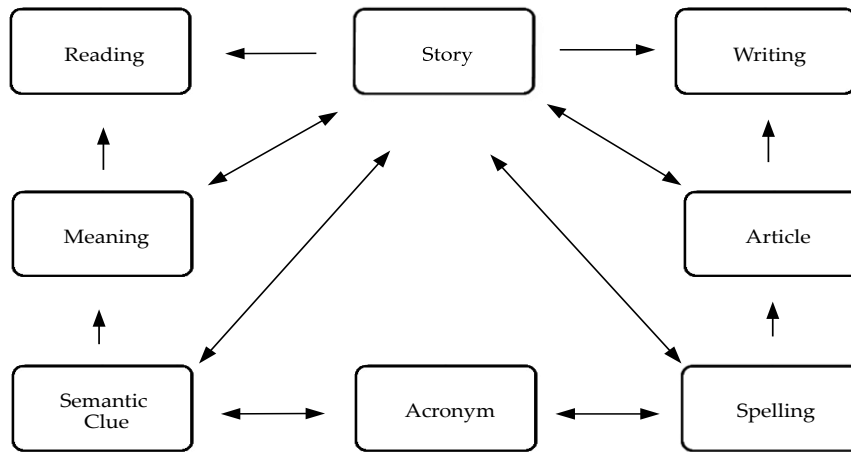
Figure 1. Mnemonic Network: English-French

Another critical element of a mnemonic network is collaboration. The facilitator should create the acronym and provide the phonetic and grammatical rules. Of course, once learners become adept with using this approach, they might create their own mnemonics, although time is probably better spent on learning new words, which entails determining the meaning of the acronym-clues and creating the story-sketches. In any case, both the learner and facilitator are active participants at every step of the process. For purpose of illustration, target vocabulary words have thus far been treated in isolation. Because a foreign language is not normally acquired in such a manner, lessons should be organized thematically. One way to do this is by introducing 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. After the puzzle is completed, the words can be reviewed by turning them into acrostics before moving on to the integrated stories.

A typical lesson using this mnemonic method would therefore begin by having the learner complete a crossword puzzle and practice pronunciation on the first day. The next lesson, preferably a few days thereafter, would review the clues through the use of acrostics, such as the following for the word *porte*:

$$
\begin{array}{l}
P\ \_\ \_\ \_\\
O\ \_\\
R\ \_\ \_\ \_\ \_\\
T\ \_\ \_\ \_\ \_\ \_\ \_\\
E\ \_\ \_\ \_\ \_\ \_\ \_\ \_
\end{array}
$$

Time intervals between exposures to new vocabulary are important, so if lessons are only once a week, for example, then the acrostics should be assigned for homework. Regardless, the focus of the second lesson should again be on meaning and pronunciation of the new words. In the final review involving the mnemonic, learners must integrate the various aspects of each word—namely, the semantic clues, meaning, pronunciation, and grammar—into a memorable story. Guidelines for such narrative sketches include that they should be brief, tend toward the concrete rather than the abstract, make use of

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sound correspondences when possible, and depict evocative, preferably interactive, images. In a classroom setting, this is a good opportunity for sharing through reading aloud or other group activities. Follow-up lessons or reviews would entail more authentic reading and writing tasks using the newly learned words.

A final feature of a mnemonic network that distinguishes it from other formal techniques is that each one should be tailored to the languages involved—hence, the use of the indefinite article 'a' for this method. To see how this works, let's suppose that the native-English speaker is not learning French but Japanese. Again, we would begin with an acronym, such as 'Initial CHinese Integer' for the target word 'one', which indicates both its pronunciation and meaning. Notice that it is the Japanese transliteration of the word (*ichi*) and not the spelling due to the different orthographic systems involved. After forging these phonetic and semantic connections, the next step is to learn how to read and write the character, or kanji, as it is called in Japanese. Due to the intricate nature of most kanji, a componential analysis of the character is necessary. In this case, however, the kanji is a pictograph composed of one element that represents an extended finger (一). A final point of distinction is that kanji are not equivalent to words in English insofar as they do not indicate discrete semantic boundaries but tend to represent general ideas that can be converted into mental pictures or concepts (see Fig. 2). Nonetheless, as in French, the learner is then asked to construct a story using the phonetic, semantic, and orthographic aspects of the target item. The Japanese word for 'one' might take the following form: Initial CHinese Integer is **one** extended finger. Note the use of alliteration in this story (the 'n' appears six times), which, like assonance and rhyme, helps facilitate recall.
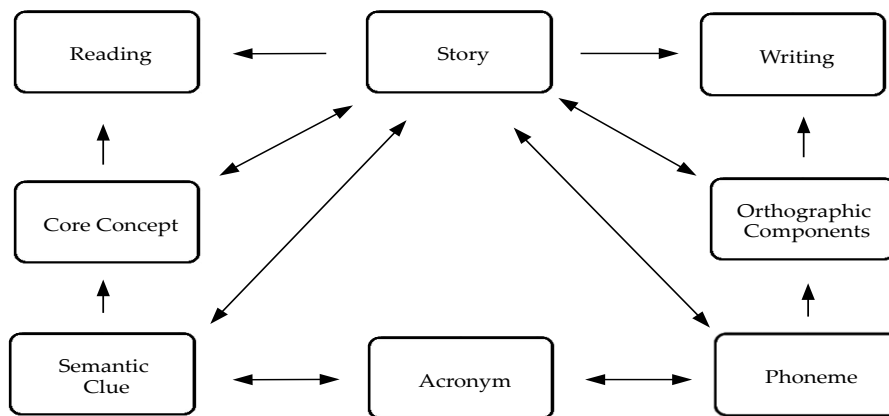

Figure 2. Mnemonic Network: English-Japanese

Rather than create a mental image to mediate between the target vocabulary word and its associated meaning in a known language as in the keyword approach, the picture already exists with the kanji itself. The mnemonic challenge, therefore, is to make it come alive in a way that is both meaningful and memorable. In a manner similar to the method of loci, the spatial referent, the imaginary box that surrounds the kanji, must be filled with easily identifiable objects upon which to attach the to-be-remembered information. The objects in this case are the components that comprise the character and information is their symbolic meaning. Adding semantic flesh to the kanji's bones, or combination of strokes, in this way, serves several purposes: first, it renders them intelligible in terms of their discriminability; and, second, it serves as an aid to retrieval by providing additional cues. Most importantly, it involves the learner in the generation of the mnemonic cues. Like the acronym-anchor and

story-sketch, the encoding process is a collaborative effort. In regards to the thousands of kanji that must be mastered to read and write Japanese, learners simply cannot be advised to discover and apply their own mnemonic cues, for it is too time consuming and runs the risk of inconsistency. Thus, they should be provided in a systematic and consistent manner that reflects the componential nature of kanji—viz., their recurring elements, commonly known as radicals.

4. Conclusion: A Meaningful Method for Remembering

Mnemonics have long been derided as examples of human artifice ill-suited to the depth of understanding requisite to achieving true knowledge. Given the innate limitations of human memory, however, the ability to acquire a large amount of new information, such as that associated with a foreign language, must receive assistance. Dictionaries, textbooks, and the like, are, after all, mnemonic aids, just as the notes one takes when attempting to recall something important. While such external mnemonics are readily accepted, those that occur in the cognitive realm are held in a more dubious light, perhaps because they are normally associated with extraordinary memory feats. For the adult learner attempting to acquire thousands of new foreign language terms, an efficient means of doing so would appear to require some type of mnemonic support. The mnemonic network method introduced here acknowledges such a challenge in a way that also respects the myriad differences between any given first and second language.

Although the learning of French and Japanese presents diverse challenges for the native-English speaker, a mnemonic network can be developed to address either situation. The key to both is their emphasis on meaning. The acronym links semantics to phonetics in the first and second languages, respectively. It also establishes cue-to-cue associations (definition to meaning) and cue-to-target associations (meaning or spelling/ pronunciation to reading or writing). The stories then provide meaningful consolidation of all cues in a context that lends itself to vivid imagery. Organizing the words either thematically, in the case of French, or according to components in Japanese, is a form of relational processing that is complemented by the elaboration that focuses on the distinctive aspects of individual items. Such discrimination that occurs in story creation in French is necessary so as not to confuse the two gender specific articles that precede nouns, for example. Similarly, the large number of homonyms in Japanese is likely to lead to interference during recall. The acronyms derive their distinctiveness vis-à-vis other homonyms at the time of encoding because they include semantic properties of the kanji, which are associated with existing knowledge of the core concept in the mother tongue. This type of meaningful elaboration not only enhances the distinguishability of each character, but, when combined with story construction that includes orthographic cues, also establishes multiple paths to retrieval—that is, a mnemonic network.

To reiterate, meaningfulness is the organizing principle of a mnemonic network. The use of acronyms, componential analysis (in the case of Japanese), and story composition all focus on meaningful tasks. The acronym forges connections between the phonetic and semantic properties of words while chunking information into more significant cues. Componential analysis seeks to make complex orthographic configurations familiar by identifying and attaching meaning to patterns, which, in turn are seen as parts of a coherent whole (i.e., the character). The stories weave together the various elements in a way that is memorable, especially when they are personalized or make use of evocative images. All of this is accomplished in a genuine collaboration between the facilitator who provides the clues, in the case of the puzzles, and the semantic scaffolding for the stories, and the learner whose job is to forge meaningful connections in the mind through cognitive and creative effort. Repeated exposure to the same material in various contexts further improves long-term retention. Organization of a large amount of vocabulary words in a coherent manner is also a critical feature of this method that ultimately seeks to make remembering more effective if not more fun.

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References

Atkinson, R. C. (1975). Mnemotechnics in second-language learning. *American Psychologist 30* (8), 821-828.

Atkinson, R. C., & Shiffrin, R. M. (1968). Human memory: A proposed system and its control processes. In K. W. Spence & J. T. Spence (Eds.), *The psychology of learning and motivation: Advances in research and theory: Vol. 2* (pp. 89-195). New York: Academic Press.

Baddeley, A. (2000). Short-term and working memory. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 77-92). Oxford: Oxford University Press.

Baddeley, A., Gathercole, S., & Papagno, C. (1998). The phonological loop as a language learning device. *Psychological Review 105* (1), 158-173.

Bahrick, H. P. (1984). Semantic memory content in permastore: Fifty years of memory for Spanish learned in school. *Journal of Experimental Psychology: General 113* (1), 1-29.

Bahrick, H. P. (2000). Long-term maintenance of knowledge. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 347-362). Oxford: Oxford University Press.

Bartlett, F. C. (1932). *Remembering: A study in experimental and social psychology*. London: Cambridge University Press.

Beaton, A. A., Gruneberg, M. M., Hyde, C., Shufflebottom, A., & Sykes, R. N. (2005). Facilitation of receptive and productive foreign vocabulary learning using the keyword method: The role of image quality. *Memory 13* (5), 458-471.

Bellezza, F. S. (1981). Mnemonic devices: Classification, characteristics, and criteria. *Review of Educational Research 51* (2), 247-275.

Brown, S. C., & Craik, F. I. M. (2000). Encoding and retrieval of information. In E. Tulving & F. I. M. Craik (Eds.), *The Oxford handbook of memory* (pp. 93-107). Oxford: Oxford University Press.

Craik, F. I. M., & Lockhart, R. S. (1972). Levels of processing: A framework for memory research. *Journal of Verbal Learning and Verbal Behavior 11*, 671-684.

Craik, F. I. M., & Watkins, M. J. (1973). The role of rehearsal in short-term memory. *Journal of Verbal Learning and Verbal Behavior 12*, 599-607.

Craik, F. I. M., & Tulving, E. (1975). Depth of processing and the retention of words in episodic memory. *Journal of Experimental Psychology: General 104* (3), 268-294.

Ebbinghaus, H. (1964). *Memory: A contribution to experimental psychology*. (H. A. Ruger & C. E. Bussenius, Trans.). New York: Dover. (Original work published 1885)

Ellis, N., & Beaton, A. (1993). Factors affecting the learning of foreign language vocabulary: Imagery keyword mediators and phonological short-term memory. *The Quarterly Journal of Experimental Psychology 46A* (3), 533-558.

Higbee, K. L. (2001). *Your memory: How it works and how to improve it* (2nd ed.). Cambridge, MA: Da Capo Press.

Masoura, E. V., & Gathercole, S. E. (1999). Phonological short-term memory and foreign language learning. *International Journal of Psychology 34* (5/6), 383-388.

Moscovitch, M., & Craik, F. I. M. (1976). Depth of processing, retrieval cues, and uniqueness of encoding as factors in recall. *Journal of Verbal Learning and Verbal Behavior 15*, 447-458.

Paivio, A. (1979). *Imagery and verbal processes*. Hillsdale, NJ: Lawrence Erlbaum.

Paivio, A., & Desrochers, A. (1981). Mnemonic techniques in second-language learning. *Journal of Educational Psychology 73* (6), 780-795.

Papagno, C., Valentine, T., & Baddeley, A. (1991). Phonological short-term memory and foreign-language vocabulary learning. *Journal of Memory and Language 30*, 331-347.

Papagno, C., & Vallar, G. (1992). Phonological short-term memory and the learning of novel words: The effect of phonological similarity and item length. *The Quarterly Journal of Experimental Psychology 44A* (1), 47-67.

Pressley, M., Levin, J. R., & Delaney, H. D. (1982). The mnemonic keyword method. *Review of Educational Research 52* (1), 61-91.

Raugh, M. R., & Atkinson, R. C. (1975). A mnemonic method for learning a second-language vocabulary. *Journal of Educational Psychology 67*, 1-16.

Rumelhart, D. E., & Ortony, A. (1977). The representation of knowledge in memory. In R. C. Anderson, R. J. Spiro, & W. E. Montague (Eds.), *Schooling and the acquisition of knowledge* (pp. 99-135). Hillsdale, NJ: Erlbaum.

Service, E., & Kohonen, V. (1995). Is the relation between phonological memory and foreign language learning accounted for by vocabulary acquisition? *Applied Psycholinguistics 16*, 155-172.

Tulving, E., & Pearlstone, Z. (1966). Availability versus accessibility of information in memory for words. *Journal of Verbal Learning and Verbal Behavior 5* (4), 381-391.

Tulving, E., & Thomson, D. M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review 80* (5), 352-373.

Wang, A. Y., & Thomas, M. H. (1992). The effect of imagery-based mnemonics on the long-term retention of Chinese characters. *Language Learning 42* (3), 359-376.

Wang, A. Y., Thomas, M. H., & Ouellette, J. A. (1992). Keyword mnemonic and retention of second-language vocabulary words. *Journal of Educational Psychology 84* (4), 520-528.

Wang, A. Y., & Thomas, M. H. (1995). Effect of keywords on long-term retention: Help or hindrance? *Journal of Educational Psychology 87* (3), 468-475.

Wickelgren, W. A. (1977). *Learning and memory*. Englewood Cliffs, NJ: Prentice-Hall.

Worthen, J. B., & Hunt, R. R. (2011). *Mnemonology: Mnemonics for the 21st century*. New York: Psychology Press.

Yates, F. A. (1966). *The art of memory*. London: Routledge & Kegan Paul.