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## Journal of Second Language Pedagogy

Journal homepage: <https://www.sanad.iau.ir/journal/jslp>

# The Orthographic Component of Mental Lexicon: A Review of its Structure, Development, and Implications for Second Language Acquisition

Saeid Najafi Sarem<sup>\*1</sup>, Amir Hossein Lotfi<sup>2</sup>

<sup>1</sup> Department of English, Hamedan Branch, Islamic Azad University, Hamedan, Iran

<sup>2</sup> Department of English Language and Literature, University of Kurdistan, Iran

<sup>\*</sup>Corresponding Author's Email: [saeidnajafi@iau.ac.ir](mailto:saeidnajafi@iau.ac.ir)

<sup>2</sup> Email: [lotfiamirhossein111@gmail.com](mailto:lotfiamirhossein111@gmail.com)

### KEY TERMS

Mental Lexicon  
Orthographic Representation  
Structure, Development  
Implications  
SLA

### ABSTRACT

The mental lexicon is essential for language processing, delineating the structural and conceptual relationships between words. While considerable research has focused on phonological, semantic, and morphological aspects, the orthographic component has received less attention. This review aims to comprehensively analyze the orthographic subcomponent of the mental lexicon, examining its structure and storage. We define orthography as the written form of language and emphasize its critical role in language development, particularly in reading and writing. The relationship between orthography and phonology is explored, highlighting that phonological knowledge typically precedes the acquisition of orthographic knowledge. Furthermore, we analyze empirical studies regarding orthographic representations' organization in alphabetic languages and logographic systems such as Chinese. Our findings suggest that while the orthographic component significantly contributes to language processing in alphabetic languages, its role in logographic languages remains less defined. We also discuss the implications of orthographic representation for language acquisition and advocate for further research in this area. Lastly, we recommend that educators integrate orthographic instruction and metacognitive strategies into their teaching practices to enhance spelling skills and improve literacy outcomes for learners.

### ARTICLE TYPE

Review Paper

Received: 19 November 2024

Revised: 22 December 2024

Accepted: 29 January 2025

Published Online: 30 January 2025

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## 1. Introduction

Among the language skills, vocabulary has been announced by many scholars to have a dominant place in the process of language acquisition. Besides grammar, pronunciation, and spelling, words are considered a fundamental language component, also called micro-skill. According to Nation (2001), vocabulary constitutes a crucial element of language, encompassing the entirety of words that an individual can access and employ in communication. Like first language acquisition, in L2 learning, a good mastery of words is considered an important linguistic ability that can affect general outcomes in language learning (Schmitt, 2010). However, as Aitchison (2003) contends, every person's storage of words is much wider than that used in everyday speech. In fact, in every human, there is a reality known as a mental lexicon, which lies somewhere in the mind and contains a limitless number of words, most of which are rarely used in communication.

Various researchers in the field of linguistics have described the concept of the mental lexicon. According to Handke (1995, as quoted in Bonin, 2004), it is the core part of a language processing system that communicates with other components and carries detailed linguistic information for both production and comprehension (p. 50). Singleton (2000) expands on this concept by referring to the mental lexicon as the internal lexicon constructed by individuals within their cognitive structure (p. 161). Aitchison (2003) also highlights that the mental lexicon is, at its most basic, about the relationship between words (p. 248). This framework proposes that the mental lexicon is a distributed network of several local sub-networks that can be flexibly adapted for different contextual uses. Bonin (2004) thereby confirms this idea by defining the mental lexicon as "a store containing all the representations of words (p. 1)".

Several studies in second language acquisition research have tried to capture the character and structure of the mental lexicon. Levelt (1995) has shown that this lexicon includes a variety of representations, such as phonological, semantic, morphological, syntactic, and orthographic features. The organization and storage of mental lexicon has been an interesting area of research and has led to favorable results concerning the phonological, semantic, and morphological syntactic representations of mental lexicon. Nevertheless, despite the great importance of the orthographic component of the mental lexicon, there seems to be a shortage of research in the literature about the structure and storage of this fundamental component.

Accordingly, this paper attempts to provide and reveal more information about the orthographic representation of mental lexicon, an aspect often overshadowed by phonological, semantic, and morphological representations. Specifically, this review focuses on three interrelated objectives: (1) to examine the structure and organization of the orthographic component within the mental lexicon, (2) to explore its development in both first and second-language acquisition contexts, and (3) to evaluate its pedagogical and theoretical implications for second language learning and teaching. By addressing these aspects, this review aims to fill the existing gap in the literature on orthographic representation and provide a comprehensive framework for understanding its role in language processing and acquisition.

## 2. Theoretical Foundations

### 2.1 Organization of the Mental Lexicon

The mental lexicon serves as a vibrant storehouse of linguistic knowledge, playing a crucial role in processing language by holding various representations of words. These representations encompass phonological, semantic, morphological, syntactic, and orthographic features, all interacting within a complex network (Levelt, 1995). This intricate setup allows quick and efficient access to linguistic information in different situations. Bonin (2004) describes the mental lexicon as a "mental repository of all representations that are intrinsically related to words" (p. 1), highlighting its integrative character.

The organization of the mental lexicon can be likened to a distributed network. This perspective suggests that words are not stored in isolation but are interconnected through various associative links. Aitchison (2003) refers to this interconnectedness as a "web of words," where semantic, phonological, and orthographic relationships form clusters of related terms (p. 138). This networked structure aids in retrieving words, as activating one word can trigger related ones. For example, when you think of "cat," it may bring to mind related terms like "feline," "kitten," or "purr."

This distributed nature of the lexicon allows it to adapt flexibly to different contexts. Taylor and Taylor (1990) note that the mental lexicon operates on shared features, organizing words based on common phonological, semantic, or orthographic traits (p. 175). This means multiple words can be activated simultaneously, improving processing efficiency. For instance, words like "unhappy," "undo," and "unlock" may be grouped due to their similar prefixes or suffixes (Aitchison, 2003).

An important feature of the lexicon is its adaptability across different languages. Research indicates that the mental lexicon is influenced by the linguistic structures of a person's language. Singleton (2000) argues that bilingual and multilingual individuals often develop separate yet interconnected lexicons for each language. He states, "L2 words are often stored separately from L1 words, but the two systems remain in communication, enabling transfer and interference effects" (p. 161). This adaptability showcases the lexicon's ability to incorporate new linguistic information while preserving its structure.

Additionally, how language is used affects how the mental lexicon is organized. Spoken and written forms activate different but overlapping representations; for instance, orthographic knowledge plays a more prominent role in reading, while phonological representations are more significant in speech (Liberman et al., 1980). This dual access mechanism illustrates the lexicon's flexibility in meeting the specific needs of various communication tasks.

Regarding the above points, the organization of the mental lexicon is a complex phenomenon that mirrors the intricacies of human language. Integrating diverse linguistic representations and adapting to contextual needs enables the smooth processing and retrieval of words. As Aitchison (2003) aptly observes, "The mental lexicon is not a static storehouse but a living, evolving system, constantly reshaped by our linguistic experiences" (p. 248).

## 2.2 The Orthographic Component of the Mental Lexicon

Building on the distributed network organization of the mental lexicon, the orthographic component emerges as an essential yet often overlooked dimension of lexical knowledge. The written form contributes significantly to how words are processed, stored, and retrieved for languages with a writing system. Singleton (2000) and Aitchison (2003) describe orthographic knowledge as the "sequence of letters" that defines a lexical item (p. 4). This dimension complements other linguistic features, such as phonology and semantics, in forming a comprehensive representation of words within the mental lexicon.

The orthographic component is intricately linked to the lexicon's network-like structure. Models proposed by McClelland and Rumelhart (1981) and Caramazza et al. (1988) conceptualize the lexicon as a system of interconnected units where activation spreads when these units are accessed. While some studies, such as Laudanna et al. (1989), argue that lexical organization is predominantly morphological, others, like Lupker and Williams (1989), provide evidence supporting the coexistence of orthographic and phonological networks. Glushko's (1979) seminal experiment demonstrated that presenting a word activates orthographically similar words, emphasizing the role of orthographic relations in adult mental lexicons. Despite these findings, no single model comprehensively explains how orthographic representations operate within the lexicon.

A critical area of inquiry involves the comparison of orthographic systems in alphabetic and logographic languages. While alphabetic languages like English rely on systematic grapheme-to-phoneme correspondences, logographic systems such as Chinese are characterized by characters that represent morphemes without direct phonological cues. In Chinese, each character occupies a square space, representing both a visual and semantic unit. This distinction raises questions about whether findings derived from alphabetic languages can be generalized to logographic systems (Lieberman et al., 1980).

In logographic systems, the interaction between orthography, phonology, and semantics is particularly complex. Connectionist models suggest that these elements form overlapping networks within the mental lexicon, allowing for multidirectional activation. For example, in Chinese, homophony—where a single syllable corresponds to multiple characters with distinct meanings—complicates retrieval processes. The syllable "ba1," for instance, can map onto various characters, each associated with different meanings and contexts. This phenomenon underscores the unique challenges of orthographic organization in logographic languages, as opposed to the more linear structure observed in alphabetic systems.

Interestingly, phonological knowledge often precedes orthographic knowledge in both L1 and L2 acquisition. Lieberman et al. (1980) proposed that access to the mental lexicon is initially phonological, with orthographic information being recoded into phonological forms during early print processing. This efficiency allows readers to leverage their existing spoken language knowledge when learning to read. Grapheme-to-phoneme correspondences serve as a bridge between written and spoken language, reducing the cognitive load required to develop orthographic competence.

Orthographic and phonological representations do not exist in isolation but are closely interwoven in the mental lexicon. Aitchison's (2003) "bathtub effect" highlights the prominence of word shapes in memory, with individuals recalling the beginnings and endings of words more effectively than their middles (p. 138). This principle is reflected in patterns like c\_\_\_\_\_ate, which links words such as calculate, communicate, and confiscate. Furthermore, McCarthy (1990) observed that L2 learners often perceive words based on both their orthographic and phonological shapes, as illustrated by silent "k" words like knife, knock, and knew. These findings underscore the role of orthographic patterns in structuring the lexicon and facilitating retrieval.

Ultimately, the orthographic component of the mental lexicon represents a complex interplay of visual, phonological, and semantic features. This interconnectedness enables efficient word processing and retrieval while adapting to the unique demands of different writing systems. Researchers can gain deeper insights into the cognitive mechanisms underlying language acquisition and processing by examining the orthographic dimension alongside other components.

### **2.3 Development of Orthographic Knowledge**

Development of the orthographic knowledge is a gradual and complex process which is shaped by various cognitive, linguistic, as well as contextual influences. It entails understanding the rules and patterns that govern a written language. This includes recognizing how letters correspond to sounds, following spelling conventions, and also acquiring specific word knowledge (Ehri, 2014). Such foundational knowledge is essential to become proficient in reading and writing, as it allows learners to decode (read) and encode (write) words successfully.

In the case of first language (L1) acquisition, children typically build their orthographic knowledge in conjunction with their phonological consciousness. Ehri and Snowling (2004) describe such a development as occurring in phases, starting with pre-alphabetic awareness and progressing through partial and complete alphabetic phases. During these stages, children learn to connect graphemes (letters) to phonemes (sounds), which is helpful in recognizing and decoding unexperienced words. As Ehri (2014) points out, "Orthographic learning begins as children internalize grapheme-phoneme correspondences and gradually build a repertoire of sight words" (p. 5). Such orthographic skills expanded during early reading contributes to more advanced abilities, such as understanding morphology (the structure of words) and syntax (sentence structure) later on.

For second language (L2) learners, the development of orthographic knowledge is often influenced by their L1 orthographic system. Learners coming from logographic or syllabic backgrounds may encounter specific challenges when learning alphabetic languages like English. Koda (2007) notes that L2 orthographic learning can be affected by transfer effects, where learners apply patterns and rules from their native language to the new language, which can sometimes lead to mistakes. For instance, learners whose first language is Chinese might struggle with English spelling because their native logographic system does not have the same grapheme-phoneme correspondences (Geva & Wang, 2001).

Several factors play a significant role in developing orthographic knowledge for both L1 and L2 learners. One critical element is print exposure; regular interaction with written texts helps

learners internalize orthographic patterns and specific word knowledge (Stanovich & Cunningham, 2004). Furthermore, explicit instruction in spelling rules and word patterns greatly enhances orthographic learning. Treiman and Kessler (2014) emphasize that "Direct teaching of orthographic principles helps learners make connections between letters and sounds, reducing the cognitive load in decoding and encoding tasks" (p. 314).

Phonological awareness also plays a vital role in this process by providing a foundation for mapping sounds to symbols. Goswami (2019) points out that phonological awareness is a "predictor of early literacy success" and serves as a precursor to developing orthographic competence (p. 19). Learners with strong phonological skills are more likely to create solid orthographic representations, facilitating efficient word recognition and spelling.

Both L1 and L2 learners encounter challenges while developing their orthographic knowledge. The irregular spelling patterns found in English—such as silent letters and homophones—can complicate the learning process. Ellis (2020) highlights that "the inconsistency of English orthography presents unique difficulties, particularly for non-native speakers" (p. 72). Additionally, limited access to print-rich environments can impede the development of orthographic knowledge, especially for students from under-resourced educational backgrounds (Moats, 2020).

On the whole, the development of orthographic knowledge is a dynamic process influenced by various cognitive, linguistic, and contextual factors. Understanding how this knowledge evolves can help inform teaching practices and support learners in acquiring compelling reading and writing skills. By recognizing students' challenges and employing effective instructional strategies, educators can improve outcomes in orthographic learning across diverse linguistic contexts.

## **2.4 Implications of Orthographic Representations for Language Acquisition**

Orthographic representations play a focal role in language acquisition as they affect comprehension and production of the language. Orthographic forms, or spellings, are particularly important for second language (L2) learners. Research recommends that experiencing orthographic input can progress vocabulary acquisition through facilitating the connection between sounds and their conforming written forms. For example, studies have demonstrated that learners who receive both auditory and orthographic input tend to retain spoken words more effectively than those relying only on auditory response (Chambré et al., 2017).

In first language (L1) acquisition, children benefit from exposure to words both aurally and in writing. This dual exposure strengthens their understanding of vocabulary and phonological structures. For instance, Ehri and Rosenthal (2007) found that children who encountered new words alongside their orthographic representations were more successful in recalling them later than those who learned the words without seeing the spelling. This suggests that orthographic knowledge enhances both word recognition and memory retention.

For adult L2 learners, the effect of orthographic forms can be more intricate. While orthographic input can assist in perceiving phonological forms of novel L2 words, it may also result in non-native-like pronunciations. Bassetti and Atkinson (2015) noted that Italian speakers learning



English often pronounced words according to their native spelling conventions, leading to less standard English pronunciations. This highlights how orthographic representations can interfere with accurate pronunciation, especially when grapheme-to-phoneme correspondences differ between languages.

Furthermore, orthographic representations affect learners' ability to retrieve and produce vocabulary. For instance, a study involving French participants learning English pseudowords showed that those who learned with orthographic forms performed better in naming tasks than those who only received the auditory form (3). However, this advantage may sometimes be accompanied by less accurate pronunciation due to the influence of the learners' native language orthography (Bassetti, 2017).

Several factors influence how orthographic representations affect language acquisition. The context in which learners are exposed to written forms—whether through direct instruction or incidental learning—can shape their understanding of orthography. Moreover, individual differences such as prior literacy experiences and phonological awareness affect how effectively learners incorporate orthographic information into their language processing.

## 2.5 Practical Applications of Orthographic Knowledge

The practical applications of orthographic knowledge are vital for enhancing learners' reading and writing skills. Orthographic knowledge refers to connecting sounds (phonemes), spellings (graphemes), and word meanings. This skill is critical for fluent reading because it enables learners to recognize words instantly through a process known as orthographic mapping. Linking spoken language to written forms allows students to identify words without decoding them repeatedly (Kilpatrick, 2019).

One key benefit of orthographic knowledge is the development of sight vocabulary—words that readers recognize automatically. A strong sight vocabulary allows learners to focus on comprehension rather than the mechanical task of decoding individual words. Research shows that proficient readers may have a sight vocabulary of 30,000 to 60,000 words stored in long-term memory through repeated exposure and practice (Ehri, 2014). For example, as learners map new words using orthographic techniques, they can quickly recall their sounds and meanings, improving reading fluency and efficiency.

Teachers play an important role in fostering orthographic knowledge by employing specific instructional strategies, such as:

- **Phoneme-Grapheme Mapping:** Using tools like sound boxes to help students break down words into sounds and link them to letters.
- **Word Sorting Activities:** Highlighting common orthographic patterns to help students identify similarities and differences in spelling.

- **Pattern-Based Spelling Lists:** Providing spelling lists focusing on rules rather than rote memorization.
- **Repeated Reading:** Encouraging students to reread familiar texts to reinforce automatic word recognition.

These strategies are particularly valuable for struggling readers, who often need extra support to develop their orthographic skills. Educators can help these learners build a solid foundation in reading and spelling by focusing on specific word patterns and offering targeted practice.

Another critical aspect of orthographic instruction is integrating phonological awareness into daily lessons. Strong phonological skills, such as blending sounds and segmenting syllables, are essential for successful orthographic mapping. Activities designed to strengthen these skills should be a regular part of the classroom routine (Ehri, 2014).

Finally, addressing the challenges of irregular spelling patterns, especially in languages like English, can improve teaching practices. For example, teachers can focus on high-frequency irregular words and explicitly teach spelling rules to help learners manage the complexities of English orthography (Ellis, 2020). This approach equips students to navigate challenging spelling patterns more effectively.

Below, there are some detailed tips that help to remember the orthography of words:

- **Use mnemonics and memory aids**

Mnemonics can be defined as cognitive instruments that can assist with storing specific orthographic data and reconstructing those memories because they establish connections between the material being learned and other information that is easier to memorize. For instance, the expanding word “accommodate” has the mnemonic, which is a phrase: A big cat catches all mice. This strategy aims at coming up with a catchy slogan or an image that is easily associated with the right spelling of a given word, both by audible and visual means. First, mnemonics become effective aids because material that is more abstract can be translated into more concrete and, therefore, more memorable forms. We have discussed this above (Miller & Gildea, 1987). This method fits with cognitive theories and how mnemonic devices assist in storing information that has been stored in long-term memory (Miller, 1956).

- **Practice word patterns and rules**

The other technique that may foster orthographic development is the routine use of past spelling conventions and drilled alphabetic patterns. When introducing words, systematic things like “i before e except after c” help in spelling mastery. It is recalled that implementing such rules aids in the learners' identification of familiar orthographic patterns, thus improving their spelling (Bear et al., 2008). What is taught in these lessons is the ability for the accumulated patterns that govern word spelling to become part of the student's long-term memory. Research has indicated that when



children learn how to spell, they need to learn the rules that govern it, which improves their orthographic knowledge (Bear et al., 2008; Caravolas et al., 2001; Moats, 2000; Treiman, 1993).

- **Engage in repeated practice**

To reinforce orthographic competence, practice through different activities should be rampant. Group practices, dictation, spelling games, and constant revision sessions help the students develop orthographic memory and enhance spelling over time (Goswami, 2002). Regular use and practice of word forms allow learners to develop spelling through reinforcement, which conforms with the theory of skills acquisition, pointing to the fact that practice is an important facet of skill acquisition (Anderson & Lebiere, 2014). Goswami (2002) also pointed out that through daily practice, learners are also highly likely to retain their spell knowledge and, at the same time, put it into practice.

- **Utilize word visualization techniques**

Techniques of word visualization include segmenting words into parts that are easier to deal with and then demeaning aspects that can help out in memory strategies. For example, the teaching technique 'Be a U-tiful' for the word beautiful is a way of simplifying complex spellings by breaking down the work into manageable parts (Pressley et al., 2006). This is in relation to cognitive theories that hold that imagery facilitates the encoding and retrieval of orthographic data (Paivio, 2013). In writing, visualization procedures assist the learners in gaining perspectives on the formation of letters within words and the best way to recall proper spellings (Pressley et al., 2006).

- **Teach spelling strategies based on phonological awareness**

Sound-letter relationship activities such as phonemic awareness exercises become critical in spelling. Such activities as sound sorting enable the learners to associate phonemes with graphemes and boost their spelling skills (Lundberg et al., 1980). Phonological awareness is a component that is very important in spelling and is known to correspond to good spelling interventions (Goswami, 2002). These activities help the learners in phonemic awareness, or the relationship between sounds and letters, which is vital for spelling (Lundberg et al., 1980).

### **3. Empirical Studies on Orthographic Representations**

This section explores empirical studies on orthographic representations across various writing systems, highlighting the distinct approaches to orthographic processing in alphabetic, logographic, and mixed systems. By examining these diverse methodologies, we can gain insights into universal strategies and system-specific techniques contributing to literacy acquisition.

Research on alphabetic languages—such as English, Spanish, and Finnish—has consistently underscored the significance of phoneme-grapheme correspondence in orthographic learning. For instance, Ehri (2014) demonstrated that children in English-speaking environments benefit from explicit phonics instruction, which aids in developing automatic word recognition. Similarly, Aro and

Wimmer (2003) found that children learning Finnish, a language characterized by a highly transparent orthography, acquire reading skills more rapidly than their English-speaking counterparts. This suggests that the transparency of an orthographic system can significantly impact the speed of literacy development.

Furthermore, studies have delved into the effects of orthographic depth on spelling accuracy and reading fluency. Katz and Frost (1992) proposed the orthographic depth hypothesis, which posits that readers of shallow orthographies tend to rely more heavily on phonological decoding. In contrast, those engaging with deeper orthographies must employ more advanced orthographic strategies. This distinction highlights how the structural characteristics of a language's writing system can shape the cognitive processes involved in reading and writing.

In contrast to alphabetic systems, logographic writing systems like Chinese and Japanese Kanji necessitate a fundamentally different cognitive approach due to their reliance on character recognition rather than phoneme-grapheme mapping. Research indicates that learners must cultivate strong visual memory and morphological awareness to master these systems effectively. For example, Shen and Bear (2000) investigated how Chinese learners develop their orthographic knowledge by recognizing radicals within characters. They concluded that understanding both semantic and phonetic components is crucial for enhancing reading comprehension. Similarly, Tan et al. (2005) emphasized the importance of visual-spatial skills in acquiring orthographic representations in Chinese.

Comparative studies have revealed shared and distinct orthographic learning processes across different writing systems. Ziegler and Goswami (2005) introduced the psycholinguistic grain size theory, which suggests that variations in reading acquisition stem from the size of linguistic units emphasized within various orthographies. Additionally, Share's (2008) comparative research highlighted the significance of self-teaching mechanisms in alphabetic and logographic systems. In this context, phonological recoding plays a vital role in alphabetic languages, while morphological decoding is more central to logographic systems. Perfetti et al. (2005) further analyzed the universal and script-dependent aspects of orthographic processing, emphasizing the interplay between phonological, morphological, and orthographic components necessary for achieving reading fluency.

In summary, empirical research on orthographic representations provides valuable understanding of how diverse writing systems shape literacy development. This knowledge enables educators to adapt their teaching methods to address the specific challenges associated with different orthographies.

## 4. Conclusion and Future Directions

Investigating the orthographic component of the mental lexicon has illuminated its vital role in language processing, acquisition, and literacy development. This review synthesizes theoretical frameworks, empirical studies, and practical applications to clarify how orthographic knowledge is organized, developed, and interacts with other elements of the mental lexicon, such as phonology and semantics.

One of this review's key insights is the mental lexicon's distributed and interconnected nature. Orthographic knowledge is integrated into a broader network of linguistic representations. Theoretical models, such as those proposed by McClelland and Rumelhart (1981), indicate that orthographic representations are not stored in isolation but are linked to phonological and semantic features. This interconnectedness facilitates efficient retrieval and processing of words, particularly in alphabetic languages like English, where grapheme-phoneme correspondences play a central role.

Moreover, empirical studies highlight the variability in how orthographic knowledge is organized across different writing systems. In alphabetic languages, the mental lexicon emphasizes systematic patterns and spelling conventions. In contrast, logographic systems like Chinese rely more on visual and semantic cues. This distinction underscores the need for context-specific approaches to understanding orthographic representation. Additionally, comparative studies reveal that transfer effects between first-language (L1) and second-language (L2) orthographic systems can both facilitate and hinder the development of orthographic knowledge in multilingual learners (Koda, 2007).

The review also identifies several challenges learners face when developing their orthographic knowledge. Irregular spelling patterns and limited print exposure can complicate this process. While phonological awareness is a foundation for orthographic learning, irregularities in languages like English may make decoding particularly difficult for L2 learners. This highlights the importance of explicit instruction and strategic teaching methods to help learners navigate these complexities.

Ultimately, orthographic knowledge is indispensable for literacy development and plays a crucial role in language acquisition. The insights presented in this review emphasize that the orthographic component should not be viewed in isolation but rather as an integral part of the mental lexicon. By bridging theoretical models with empirical findings, this review contributes to a more comprehensive understanding of how orthographic knowledge evolves and functions across diverse linguistic contexts.

Despite the advancements made in this field, significant gaps remain in our understanding of the orthographic component of the mental lexicon. Future research could focus on several areas:

1. **Cross-Linguistic Comparisons:** There is a need for more studies comparing orthographic organization in both alphabetic and logographic languages, particularly within multilingual settings.
2. **Development in Special Populations:** Investigating how individuals with dyslexia, illiteracy, or other cognitive challenges develop their orthographic knowledge could yield valuable insights.

3. **Technological Integration:** Researching the role of digital tools and applications in supporting orthographic learning—especially in L2 contexts—can have practical implications for language education.
4. **Longitudinal Studies:** Tracking the development of orthographic competence over time in both L1 and L2 learners could deepen our understanding of how this skill evolves.

Based on these findings, educators should consider integrating orthographic instruction into the broader literacy curricula while emphasizing the relationship between phonology and orthography. Approaches such as explicitly teaching spelling rules, phoneme-grapheme mapping, and employing metacognitive strategies can enhance learners' ability to decode and encode words effectively. Additionally, fostering print-rich environments and providing access to diverse reading materials will support orthographic development—particularly for learners from under-resourced backgrounds.

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