

L2 word processing: A review from a word form perspective

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ABSTRACT

The English language contains a large number of inconsistent and irregular words, due to its lack of phonological transparency. This lack of transparent orthography may cause L2 learners to have trouble with word forms. L2 learners also create connection between word forms and word meanings partly depending on their morphological knowledge of new words. There is mounting evidence that orthographical knowledge and morphological knowledge are closely related to English vocabulary development, suggesting that knowledge of orthography and morphology may be an essential metalinguistic knowledge underlying successful L2 vocabulary acquisition. This review provides an overview of research on the role of the word features of orthography and morphology and their influence on how an English word is processed and learned.

INTRODUCTION

Word knowledge plays an essential role in all aspects of second language (L2) acquisition. However, words do not share a similar learnability for L2 learners. Why are some L2 vocabulary items more difficult to learn than others? Laufer (2013) suggests that the difficulties of learning a word may be attributed to the interaction between the word and other words, the familiarity of the word to the learners either in their first language (L1) or in the target language,

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and the word itself. In order to understand the intrinsic difficulty of a word itself, it is important to know the construction of a word.

Knowing a word's written form requires knowing the concept of the lemma and/or the word family. There is a distinction between these two lexical form constructs. The lemma is "a set of lexical forms having the same stem and belonging to the same major word class, differing only in inflection and/or spelling" (Francis & Kučera, 1982, p. 1). Examples of lemma sets are base forms of verbs together with their inflected forms (e.g., *listen*, *listens*, *listened*, and *listening*), including irregular verb forms in a lexical set, such as *go* and *went* (Gardner, 2007). The noun derivative form *listener*, however, can also have its own lemma set (e.g., the singular form *listener* and the plural form *listeners*). Research suggests that the most frequent and regular affixes, normally included in the lemma, are acquired rather early. This is because inflections are more readily mastered by learners than derivations (Ward & Chuenjundaeng, 2009).

A word family, on the other hand, comprises a base word with its inflections and derivations that can be recognised by a learner without the extra effort of having to learn each form separately (Bauer & Nation, 1993). For example, *listen*, *listens*, *listened*, *listening*, and *listener* are grouped into one word family. Knowing one member of a word family, it is suggested, may facilitate the recognition of other members of the family. However, studies indicate that L2 learners face difficulties with processing the written form of words (Bensoussan & Laufer, 1984; Grainger & Dijkstra, 1992).

Linking knowledge of word form and word meaning is an initial stage of learning a new word. L2 learners create this connection partly depending on their morphological knowledge regarding the new word, as morphemes encode semantic information (Henderson, 1982). In the English language, the largest portion of a morpheme is the word root, and the most frequently occurring morphemes are affixes (Minkova & Stockwell, 2009). Thus, affix knowledge development appears to be important for learning new English words. Research has shown that affix knowledge plays a significant role in word building (e.g., Hayashi & Murphy, 2011; Mochizuki & Aizawa,

2000; Nagy, Diakidoy & Anderson, 1993; Schmitt & Zimmerman, 2002; Tyler & Nagy, 1989).

Moreover, according to the Orthographical Depth Hypothesis (ODH) (Katz & Frost, 1992), English orthography is classified as a phonologically 'deep' writing system. The English language involves a large number of inconsistent and irregular words due to its lack of phonological transparency. This less transparent orthography may cause L2 learners to have trouble with word form. L2 learners must be aware English orthography's written symbols correspond to speech units and the distribution of letter strings for accurate spelling. Previous research has shown that mastery of alphabetic literacy, such as English orthography, requires competence in decoding words into phonemes and morphemes (Shankweiler & Lundquist, 1992). Therefore, reviewing literature focusing on metalinguistic knowledge of word forms is essential to broaden our understanding of the relations among L2 learners' knowledge of morphology, their knowledge of orthography, and the processing of L2 words.

A recent L2 vocabulary acquisition study by Lin (2015) suggested that L2 learners' knowledge of word parts and affixes may facilitate the processing of new words with a prefix-base-suffix structure; and their orthographical knowledge of graphemes (letters) and phonemes (sound) may contribute to word decoding skill and may facilitate managing spelling successfully. Nevertheless, there has been a notable lack of review of existing research on the relevance of the word features of orthography and morphology to L2 vocabulary acquisition. This review is an attempt to fill this gap by evaluating evidence for the relationship between the knowledge of orthography and morphology and L2 word processing and by discussing possible implications for L2 vocabulary research and L2 vocabulary teaching and learning.

ORTHOGRAPHY

The orthographical form of a word is one of the elements of word knowledge. L2 learners have to master this in two ways: First, recognising a written form (receptive skill); and, second, producing a

written form that other readers can also recognise (productive skill). Both receptive and productive skills regarding a word's written form refer to the ability to write and to spell accurately (Ryan, 1997). Spelling provides a visible representation of phonological and orthographic understanding (Strattman & Hodson, 2005). In alphabetic language systems, the primary unit of representation is a phoneme (unit of sound), and the string of these sounds (or letters) together represents the morpheme. The segmental nature of the information represented by individual symbols requires learners to attend to the systematic analysis of component letters and letter clusters within a word (Koda, 1999). Mastery of alphabetic literacy requires competence in decoding words into phonemes and morphemes (see e.g., Shankweiler & Lundquist, 1992).

The relation between phonological forms and their orthographic symbols has been established mainly in two fields. The field of psycholinguistic research has looked at the effect of orthography on word recognition (Perre & Ziegler, 2008; Taft, 2001), that is, the effect of grapheme-to-phoneme inconsistencies and phoneme-to-grapheme inconsistencies on word recognition (Pattamadilok *et al.*, 2007; Ziegler *et al.*, 2008). The field of reading acquisition (Simon & Herreweghe, 2010) has looked at the role of orthography in phonemic awareness and syllabic awareness (Cheung *et al.*, 2001; Goswami *et al.*, 2005; Tyler & Burnham, 2006). Little research has been carried out on how such decoding skills may exert influence on second language vocabulary acquisition (Simon & Herreweghe, 2010).

Word decoding

Decoding is a skill that involves the process of converting the written symbols of an alphabetical writing system into the sounds they represent, using knowledge of the language's grapheme-phoneme correspondences (Woore, 2010). In other words, decoding is the "phonological conversion of visually presented words" (Hamada & Koda, 2010, p. 514), and is seen as the strongest predictor of acquiring orthographical knowledge, as the decoding process can form a basis for a new word form to be learned (Share, 1995). The relation between decoding skills and spelling is close (Strattman & Hodson, 2005). This is because decoding skills and spelling develop in

a similar pattern, depending on knowledge of the alphabetic writing system code and grapheme-to-phoneme correspondences. In many cases, when a new word is encountered in print, learners with basic word reading skills may attempt to translate its written form into its spoken form. However, some decoding attempts may not be successfully processed due to a learner's poor decoding skills, or due to unfamiliar spelling. For example, the written form *yacht* could lead to mispronunciation due to its unusual spelling form (Ricketts *et al.*, 2011).

In L1 contexts, word decoding by analysis of specific features of orthography can be used to predict the order of word learning. Elbro (2006) developed a sequence of lexical acquisition in Danish by analysing the following intraword structural patterns: (1) learning of one-letter-to-one-sound correspondences; (2) learning of vowel-consonant combinations; (3) learning of spelling based on morphemic orthographic knowledge; and (4) learning of word-specific orthographic patterns. The order of learning Danish orthography therefore can predict that one-to-one grapheme-to-phoneme correspondences are learned first, and then more complicated and unusual patterns are learned later.

A recent longitudinal word decoding study conducted by Verhoeven and van Leeuwe (2009) investigated the growth of word decoding skills in 2,819 Dutch children for three orthographical patterns: (1) regular consonant-vowel-consonant (CVC) words; (2) complex monosyllabic words with consonant clusters immediately preceding a vowel and immediately following a vowel; and (3) polysyllabic words. The findings suggested a Dutch orthography development order and showed children were most successful at decoding CVC patterns, and then monosyllabic words with consonant clusters; polysyllables were the least successful word group to be decoded by the participants. The results also suggested that the children's ability of decoding words slows as the word length and orthographic complexity increases.

Taken together, the knowledge of phonological structure and the knowledge of mapping it onto its correspondent orthographical symbols facilitate an alphabetic L1 child's decoding skill and allow the

child to recognise and produce words (e.g., Kerek & Niemi, 2009; Verhoeven *et al.*, 2006).

Orthographic Depth Hypothesis (ODH)

The ease of word decoding may differ across languages depending on a word's orthographic depth (Frost *et al.*, 1987). In other words, phonological processing may be universal across languages; however, the level of processing may be constrained by the nature of orthographies (Perfetti *et al.*, 1992). Katz and Frost (1992) proposed the Orthographic Depth Hypothesis (ODH) to describe how orthographic depth affects phonological decoding procedures across writing systems. In 'shallow' orthographies, a phonological code is systematically organised in working memory through one-to-one letter-to-sound translation, as is the case in Spanish, Serbo-Croatian, and Korean Hangul. The grapheme-phoneme correspondences for these languages are regular, and thus transparent. In contrast, in less transparent 'deep' orthographies, a phonological code may be gained only after a word has been identified, depending on the learners' existing lexical knowledge. In other words, orthographic depth refers to the degree of lexical involvement in obtaining a word's phonology (Koda, 1999).

English orthography

English orthography is classified as a phonologically 'deep' writing system. This is because the English language has poor levels of phonological transparency and this limits systematic one-to-one letter-to-sound mappings (Koda, 1999). In other words, the English language involves considerable inconsistency and irregularity in the spelling of words, making its orthographic structure rather complex to process (Ricketts *et al.*, 2011). Evidence from previous comparison studies indicates that the development of word decoding varies between languages. Landerl (2000) replicated the study of Wimmer and Goswami (1994) to compare the reading development of young English and German children. Findings from both studies were consistent and showed that English children had substantially more difficulties reading pseudowords than German children did.

Word decoding in English has been shown to develop more slowly and less efficiently than in shallow alphabetic languages (see e.g., Aro & Wimmer, 2003; Ellis & Hooper, 2001; Landerl, 2000; Patel *et al.*, 2004; Seymour *et al.*, 2003). Factors for this consistent result may be attributed to orthographic differences in regularity and the varying degrees of orthographic transparency for different writing systems. For example, Ziegler, Stone, and Jacobs (1997) showed that, while 31% of all English monosyllabic words were found to inconsistently feed forward (in the direction of spelling to pronunciation), only 12% of French monosyllabic words were found to be inconsistently corresponding.

In comparative studies on literacy learning in different languages, cross-linguistic differences in orthographic regularity are frequently discussed along the continuum from 'deep' to 'shallow' (see e.g., Berninger, 1994). Seymour, Aro, and Erskine (2003) reported the degrees of regularity for seven alphabetic languages, English, French, Dutch, Swedish, German, Spanish, and Finnish, using a hypothetical classification of orthographic depth continuum. When locating these languages on the continuum of orthographic depth, they suggested that English is the most inconsistent language, and Finnish is the most consistent language. Finnish has the most regular and systematic grapheme-phoneme correspondences, followed by Spanish. Previous evidence also showed that 'shallow' orthographies (e.g., Finnish and Spanish) may be easily learned based on a single phonological process, whereas 'deep' orthographies (e.g., English and French) require both phonological and visual-orthographic processes, that is, the acquisition of word-specific orthographic representations (see e.g., Share, 2004). This is because in such opaque deep orthographies, different letters may represent the same sound, and one and the same letter may represent different sounds (Verhoeven *et al.*, 2006).

Despite English orthography having many inconsistencies with regard to how vowels are represented in the writing system and a variety of letter-sound irregularities, English orthography encodes considerable phonological information through letter-sound correspondence rules (Berent & Perfetti, 1995; Cortese & Simpson,

2000). Therefore, in addition to phonological processing skills, the ability to acquire English words is in part accounted for by orthographic processing skills and knowledge, particularly with irregular letter-sound correspondences (Barker *et al.*, 1992; Olson *et al.*, 1994). The importance of the acquisition of orthographic-specific representations of words (irregular spellings) that occurs across the English orthography is thus critical for learning English words (Perfetti, 1991; Plaut *et al.*, 1996; Rey *et al.*, 2000).

L1-L2 orthographic distance

Studies have examined L1 word decoding with children (e.g., Elbro, 2006; Kerek & Niemi, 2009; Ricketts *et al.*, 2011; Share, 2004; Strattman & Hodson, 2005; Verhoeven *et al.*, 2006; Verhoeven & van Leeuwe, 2009). In L2 contexts, learners' first language (L1) background and alphabetic orthography systems (or logographies) are seen as relevant. The contrast between alphabetic and logographic writing systems lies in the varying degrees of reliance on phonological codes and graphic symbols during L2 decoding (Koda, 2013). Specifically, the segmental nature of alphabetic languages, such as English and Korean, requires learners to systematically analyse component letters and letter clusters within a word in order to acquire lexical processing competence. This is because the basic unit of alphabetic representation is a phoneme (phonological code). In contrast, the unit of representation in logographic writing systems, such as Chinese characters and Japanese Kanji, is the morpheme (graphic symbol). Learners process such logographies mainly through a mental device that triggers whole-word activation, since each logographic symbol is associated with the meaning and the sound of an entire word or morpheme (Koda, 1999).

The degree of similarity between L1 and L2 orthographic properties is thus a significant determinant for transferred decoding skills to function in the L2 (Hamada & Koda, 2010). The idea is that for learners whose L1 orthographic properties are similar to the L2 properties, L1 decoding skills can be applied to the L2. However, if L1 and L2 orthographic systems are not similar, learners may face difficulties with the transfer process. It can be assumed that when learners' L1 is orthographically dissimilar to the L2, they would need

more time and effort to accurately decode the L2 word in order to master the word.

Hamada and Koda's (2008) experimental study reported that Korean learners ($n = 17$) performed better overall in retention, whereas Chinese learners ($n = 18$) performed better with irregular word forms (as measured by a pseudoword naming task with phonologically regular and irregular conditions). In a follow-up study over a longer period, Hamada and Koda (2010) found that the alphabetic L1 group was associated with better decoding (again as measured by a pseudoword naming task), whereas the two groups (alphabetic L1 orthographic background, $n = 16$, and logographic L1 background, $n = 17$) did not differ in a meaning-inference task when they read three passages that contained pseudowords. Together, the findings from these studies suggested that similarity between L1 and L2 orthographic properties promotes L2 decoding efficiency and provided evidence of the effect of distance of L1 orthography and L1 orthographic experience in L2 word decoding, which is consistent with previous studies that provided strong empirical support for the congruity effect on L2 decoding efficiency (see e.g., Koda, 1999, 2000; Muljani *et al.*, 1998; Wang *et al.*, 2003).

Nevertheless, a recent experimental study using real words to test the effect of distance of L1 orthography and L2 orthographical knowledge on L2 word processing provided a different view. Lin (2015) reported that logographic Japanese L1 university students ($M = 14.09$, $SD = 3.65$, $n = 44$) performed better English decoding skill than alphabetic Spanish L1 university students ($M = 13.23$, $SD = 4.49$, $n = 43$). The study also showed that Japanese university students recognised and produced more target words than alphabetic Spanish university students, suggesting that logographic L1s facilitate the learning of English words more than alphabetic L1s. However, Lin herself indicated that the generalisability of the findings was limited due to the small sample size from each language group and similarities in the participants' ages and their L2 proficiency levels.

Overall, research shows that English orthographical knowledge of L2 learners may influence English words to be learned, but may also vary due to the learners' L1 experiences and the distances between

learners' L1 and English. English orthography is governed by phonemic constraints, yet it tends to favour morphological information at the expense of phonological transparency (Hamada & Koda, 2008). Hence, "many spelling irregularities in English are more readily explained by morphological, rather than phonemic, regularities" (Hamada & Koda, 2008, p. 5). That is to say, in addition to loanwords (i.e., Latin and French borrowings), many of the phonographic irregularities of English are due to the conservation of a different sort of regularity, such as morphemes, that between spelling and lexical meaning (Henderson, 1982).

MORPHOLOGY

Morphology is the study of various parts of word form in language, that is, the analysis of words. Words are not the smallest units of meaning in language, morphemes are. Words are made up of morphemes. A word can contain one or more morphemes. For example, the English word *listen* is made up of one English morpheme. The English word *listen-er* is made up of two English morphemes. The English word *listen-er-s* is made up of three English morphemes. Morphemes serve both a grammatical function through inflection (e.g., plural *-s* or past tense *-ed*) and a lexical function through derivation (e.g., *-ic* changes nouns to adjectives, as in *class* to *class-ic*), or compounding (e.g., *book + mark*) (Jarmulowicz *et al.*, 2008).

Inflectional morphemes in English are always suffixes and attached to base words to indicate grammatical or semantic relations between different words in a sentence without changing the meaning or part of speech (Kuo & Anderson, 2006). For example, verbs in English may be indicated by inflectional morphemes for tense (e.g., *listen*, *listen-ed*) and person (e.g., *I listen*, *he listen-s*). Nouns may be inflectionally marked for agreement with other words in the sentence for number (e.g., *one apple*, *two apple-s*).

Derivational morphemes in English, however, can be added either as a prefix (attached at the beginnings of base words) or as a suffix (attached at the ends of base words). Derivational prefixes can change the meaning of a word, but cannot change its grammatical

properties, such as the words *available* and *un-available*, both of which are adjectives. The majority of derivational suffixes can change the part of speech of a word, such as the words *listen* (verb) and *listen-er* (noun), with some exceptions (e.g., the words *terror* and *terror-ism*, both are nouns). Derivational morphemes are normally less productive and more restrictive in the ways they can be combined with certain types of base words, than inflectional morphemes. For example, the derivational suffix *-able* can be added to verbs but not to nouns to form adjectives in English (Kuo & Anderson, 2006). Finally, compounding is combining two or more base words to form new words, such as the word *house-wife*.

In sum, morphological information involves base words, syntactic inflections, and derivational relations that constitute the minimal semantic and grammatical units of a language (Verhoeven & Perfetti, 2003).

Morphological awareness in vocabulary development

This section will review the literature on the role of morphological awareness in vocabulary development. Knowledge of morphology is believed to facilitate new words, particularly morphologically complex words, to be comprehended and produced (Kuo & Anderson, 2006). Hence, developing morphological awareness is essential for alphabetic language learners. The explicit understanding of word structure constitutes morphological awareness, that is, the ability to distinguish and manipulate morphemes and morphological rules that guide the possible combination of morphemes in a language (Carlisle, 2003; Kuo & Anderson, 2006).

Learners with the ability to perform morphological analysis can decompose unknown morphologically complex words into their constituent morphemes and manipulate word formation rules to derive meanings of unknown words. In other words, morphological awareness may facilitate the decomposition of morphologically complex words by the knowledge of pairing of sound and meaning; and such metalinguistic knowledge has often been found to be a significant contributor to word learning and vocabulary knowledge development (e.g., Anglin, 1993; Carlisle, 2000; McBride-Chang *et al.*,

2008; Nagy *et al.*, 2006; Paribakht & Wesche, 1999; Wysocki & Jenkins, 1987).

The unique contribution of morphological awareness to word learning, according to Tyler and Nagy (1989), could be due to three possible reasons: First, learners' ability to recognise the base forms of morphologically complex words and reflect their understanding of the relations between the base forms and derived words (relational knowledge); second, learners' grammatical knowledge of the changes of parts of speech that caused and produced by derivational suffixes (syntactic knowledge). Finally, learners' understanding of how affixes are constrained by the syntactic category of the base forms they attach to (distributional knowledge).

Among these three aspects of derivational knowledge, Tyler and Nagy (1989) found that learners acquired the ability to recognise a familiar base word in a derivative earlier than the syntactic sensitivity of derivational suffixes. The most challenging level of derivational awareness is distributional knowledge, and is developed at a later stage after relational and syntactic knowledge. This observation of derivational knowledge development seems reasonable because without being able to recognise the base word in a morphologically complex word or to differentiate different grammatical categories, one can hardly identify the distributional constraints on derivational suffixes (Kuo & Anderson, 2006). Evidence from earlier research in L1 morphological awareness conducted by Wysocki and Jenkins (1987) showed that English-speaking children used their derivational awareness to facilitate their learning of new words. Anglin (1993) also showed that the number of derived words learned by English-monolinguals was more than three times as many as the number of base words they learned from Grade 1 to 5. Similarly, Carlise (2000) found that derivational awareness contributed to a large amount of variance in vocabulary knowledge among English-speaking children. Together, the findings from these studies point to learners' knowledge of derivational affixes as a strong predictor of English vocabulary size.

In L2 contexts, unlike inflectional morphemes which share the common function of denoting grammatical features, derivational

morphemes may be less susceptible to cross-linguistic transfer, particularly when the derivational principles governing each language are highly dissimilar (Saiegh-Haddad & Geva, 2008). L2 learners normally have difficulty in producing complete derivative forms within a word family, although knowing one member of a word family can facilitate receptive acquisition of the other members (Bauer & Nation, 1993). Knowledge of different members of a word family seems to carry a different learning burden. For example, inflections and derivations appear to impose different learning burdens (Schmitt & Zimmerman, 2002). Even highly proficient L2 learners can produce unacceptable word forms. Jiang (2000) suggested that knowledge of derivational suffixes is often not integrated with learners' L2 lexicon due to the fact that many words may be fossilised before the last stage of L2 word learning, that is, the learning of syntactic and morphological specifications.

While a robust relationship has been reported between L2 learners' morphological awareness and their first language morphological experience (e.g., Koda, 2008; Ku & Anderson, 2003; Ramirez *et al.*, 2011; Zhang & Koda, 2013), some studies indicated that the level of L2 learners' morphological awareness is important for word building because morphological knowledge is one aspect of depth of word knowledge (Nation, 2001; Read, 2000). For example, in Qian (2004), Korean and Chinese ESL learners were found to frequently use intra-word morphological cues to deal with unfamiliar words encountered in reading. In addition, Zhang and Koda (2011) reported that morphological awareness was significantly associated with lexical inferencing, vocabulary size, and vocabulary depth. Zhang and Koda (2011) also found that the Chinese university students' morphological awareness contributes to L2 vocabulary knowledge directly and indirectly through the mediation of their lexical inferencing skill. The findings suggest that L2 learners who have better morphological awareness appear to learn words better, and in turn, have a larger vocabulary size.

In a recent study looking at the relationship between L2 learners' morphological knowledge and their receptive and productive word knowledge, Hayashi and Murphy (2011) reported that both receptive

and productive vocabulary knowledge was found to account for 73% of the variance in the Japanese learners' productive morphological awareness, whereas neither receptive nor productive vocabulary knowledge made an independent contribution to participants' morphological awareness. Other research such as Lin (2015) has indicated a strong link between morphological knowledge and word recognition ($r = .50$, $N = 137$) and a strong association between morphological knowledge and word production ($r = .52$, $N = 137$). Lin has also reported that morphological knowledge significantly contributes to both L2 word recognition ($\beta = .486$, $p < .001$) and L2 word production ($\beta = .497$, $p < .001$). The findings were consistent with the study of Zhang and Koda (2011) and other previous L2 studies (e.g., Mochizuki & Aizawa, 2000; Paribakht & Wesche, 1999; Schmitt & Meara, 1997). Taken together, morphological awareness can contribute to enlarging vocabulary size, enhancing the depth of word knowledge, and providing a pathway to master morphologically complex words by deeper associations with more members of a word family (Hayashi & Murphy, 2011).

Given the evidence that segmenting a spoken word into phonemes (orthographical knowledge) should pave the way for the acquisition of word decoding in English orthography (Shankweiler & Liberman, 1972), learners' conscious awareness of the word structure and their ability to reflect on and manipulate that structure (morphological knowledge) also provides a clue to the phonological representation of complex words and to their meaning for learning English language (Carlisle, 2000). This is because "morphemic boundaries in English coincide with phonemic boundaries" (Saiegh-Haddad & Geva, 2008, p. 484).

In her recent research, Lin (2015) investigated the role of word features (i.e., morphology and orthography), with a specific focus on the *written form* of a word, on word learnability in the second language (L2). The sample involved 137 ESL university students. 24 low-frequency words unfamiliar to the participants were chosen as the target words. Metalinguistic knowledge of morphology and orthography tests, an L1-to-L2 receptive knowledge of orthography test, and an L1-to-L2 productive translation test were used as the

research instruments. Empirical evidence from the study suggests that both morphological knowledge and orthographical knowledge of L2 learners are important for the learning of words, but to different extents. Morphological knowledge appeared to be a better facilitator for L2 word learnability than orthographical knowledge. The combination of these two metalinguistic factors contributed 30.3% of the variability in productive L2 word learnability and 26.8% of variability in receptive L2 word learnability, suggesting that L2 learners' knowledge of morphology and their knowledge of orthography were like two sides of a coin; both were substantial for facilitating learning new words.

In summary, the research carried out in various L2 contexts suggests that orthographical knowledge (e.g., Hamada & Koda, 2010; Koda, 1999; Lin, 2015; Ricketts *et al.*, 2011) and morphological knowledge (e.g., Hayashi & Murphy, 2011; Jiang, 2000; Kuo & Anderson, 2006; Lin, 2015; Mahony *et al.*, 2000; Schmitt & Zimmerman, 2002) are related to learners' overall L2 vocabulary development and word processing efficiency. While adult L2 learners' level of morphological awareness and affix knowledge (e.g., Carlisle, 2000; Hayashi & Murphy, 2011; Ku & Anderson, 2003; Lin, 2015; McBride-Chang *et al.*, 2008; Mochizuki & Aizawa, 2000; Nagy *et al.*, 2006; Paribakht & Wesche, 1999; Qian, 2004; Schmitt & Meara, 1997; Wysocki & Jenkins, 1987; Zhang & Koda, 2011) may influence an L2 word to be learned, their L1 orthographic experience (e.g. Hamada & Koda, 2008; Lin, 2015; Wang *et al.*, 2003) and L1 morphological experience (e.g., Koda, 2008; Ramirez *et al.*, 2011; Zhang & Koda, 2013) also play a significant role in L2 word processing. Taking all the above into account, the ease or difficulty of processing and learning a word form depends in part on its orthographic nature and the distance between L1 and L2 orthographies. The relationship between morphological knowledge and word learning is also evident, and derivational morphological knowledge appears to be the most difficult kind of knowledge for ESL learners to acquire.

IMPLICATIONS FOR FUTURE RESEARCH

This review has shown that an L2 word's orthographic nature and the degree of similarity between L1 and L2 orthographic properties may

affect the way a word is processed or learned (e.g., Hamada & Koda, 2010; Koda, 1999; Lin, 2015; Ricketts *et al.*, 2011). The important role that morphological knowledge plays in the learning of English word structure has also been shown. The evidence is, therefore, that learning and processing English written forms, is influenced by both orthographic and morphological information about a word. However, the majority of available L2 research seems to be limited to the domain of L2 word identification and L2 decoding efficiency, and the comparison of two linguistic groups.

In addition, this review has shown that orthographic distance differs across L2 learner groups. The theoretical idea is that when L1 and L2 writing systems share similar properties, L1 skills are ready to be transferred in order to facilitate learning the target language; in contrast, when the two are typologically distinct, L1 skills then require modification to be functional in the target language. The current review has shown that the acquisition of L2 vocabulary was found to be influenced by L2 learners' first language knowledge and experiences (e.g., Hamada & Koda, 2008; Lin, 2015; Wang *et al.*, 2003). However, these studies tell us little about how L2 learners' L1 orthographic knowledge influences L2 word processing.

To fill these gaps, future research should seek to further extend our understandings of the effects of English orthography and morphology on L2 vocabulary acquisition. For example, future research could test the hypothesis that L2 learners from cognate language backgrounds (alphabetic languages) possess better L2 morphological and orthographical skills and that these contribute more to their L2 word processing than L2 learners from non-cognate language backgrounds on a larger scale. From a methodological point of view, future research could also test this hypothesis by involving cognate words, non-cognate words, and pseudowords in the target words. It is also important to note that the majority of previous L2 vocabulary research using real words, such as Lin (2015), only examined morphological knowledge using derived words. Future studies on the effect of morphological knowledge could involve different aspects of morphological knowledge, including inflections, derivations, and compound words, to understand how each aspect of

morphological knowledge contributes to L2 vocabulary knowledge across learners with different L1 orthographic distances. Such research could clarify how cross-linguistic transfer of metalinguistic knowledge is constrained orthographic distance, L1 literacy level, L2 proficiency, and vocabulary knowledge.

IMPLICATIONS FOR L2 VOCABULARY TEACHING AND LEARNING

This section provides suggestions for practical vocabulary teaching and learning techniques in L2 classrooms. First of all, practitioners need to be aware of the importance of explicit and systematic instruction in morphologically complex word decomposition, as using word parts to remember words could be one of the best strategies to facilitate L2 vocabulary acquisition. It is worth noting that the degree of English morphological transparency, which refers to the degree to which the sound and the meaning of a complex word may be identified from its internal morphological structure (Elbro & Arnbak, 1996), is generally high. This is because morphological processes in English are linear (Saiegh-Haddad & Geva, 2008); that is, English utilises prefixing or suffixing to derive new words from base words. Therefore, when L2 learners encounter an unfamiliar word that contains parts they are familiar with, such as the base word or affix, they may easily relate the meaning of the known parts to the meaning of the word (Nation, 2013).

In addition, word decoding skills that emphasise recognising and using orthographic units, such as mapping the spoken form (sounds) onto the written form (letters), are also recommended to be explicitly taught (Westwood, 2008), particularly, for those less morphologically transparent words. This is because, when affixes are added to the beginning or to the end of a base word, this may sometimes cause the base word to undergo a phonological and/or orthographic shift, and this in turn may cause vocabulary learning difficulties for L2 learners. In addition, phonological decoding skills are likely to facilitate English word spelling (Lin, 2015). Hence, explicit instruction in letter-to-sound correspondences is highly recommended for ESL/EFL learners. This is especially important for learners from non-cognate language backgrounds, as phonological skills in linking sounds and letters, as

well as using such knowledge to learn new English words, are not intuitively developed for these learners.

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REFERENCES

- Anglin, J. M. (1993). Vocabulary development: A morphological analysis. *Monographs of the Society for Research in Child Development, 58*(10), i+iii+v-vi+1-186.
- Aro, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics, 24*, 621-635.
- Barker, T., Torgesen, J., & Wagner, R. (1992). The role of orthographic processing skills on five different reading tasks. *Reading Research Quarterly, 27*, 335-345.
- Bauer, L., & Nation, I. S. P. (1993). Word families. *International Journal of Lexicography, 6*, 1-27.
- Bensoussan, M., & Laufer, B. (1984). Lexical guessing in context in EFL reading comprehension. *Journal of Research in Reading, 7*(1), 15-32.
- Berent, I., & Perfetti, C. A. (1995). A rose is a REEZ: The two-cycle model of phonology assembly in reading English. *Psychological Review, 102*, 146-184.
- Berninger, V. W. (Ed.) (1994). *The varieties of orthographic knowledge: Theoretical and developmental issues*. Dordrecht, Netherlands: Kluwer Academic Press.
- Carlisle, J. F. (2000). Awareness of the structure and meaning of morphologically complex words: Impact on reading. *Reading and Writing: An Interdisciplinary Journal, 12*, 169-190.

- Carlisle, J. F. (2003). Morphology matters in learning to read: A commentary. *Reading Psychology, 24*, 291-332.
- Cheung, H., Chen, H. C., Lai, C. Y., Wong, O. C., & Hills, M. (2001). The development of phonological awareness: Effects of spoken language experience and orthography. *Cognition, 81*, 227-241.
- Cortese, M. J., & Simpson, G. B. (2000). Consistency effects: What are they? *Memory & Cognition, 28*, 1269-1276.
- Elbro, C. (2006). Literacy acquisition in Danish: A deep orthography in cross-linguistic light. In M. Malatesha Joshi & P. G. Aaron (Eds), *Handbook of orthography and literacy* (pp. 31-45). Mahwah, NJ: Lawrence Erlbaum.
- Elbro, C., & Arnbak, E. (1996). The role of morpheme recognition and morphological awareness in dyslexia. *Annals of Dyslexia, 46*, 209-240.
- Ellis, N. C., & Hooper, A. M. (2001). Why learning to read is easier in Welsh than in English: Orthographic transparency effects evinced with frequency-matched tests. *Applied Psycholinguistics, 22*, 571-599.
- Francis, W. N., & Kučera, H. (1982). *Frequency analysis of English usage*. Boston, MA: Houghton Mifflin.
- Frost, R., Katz, L., & Bentin, S. (1987). Strategies for visual word recognition and orthographic depth: A multilingual comparison. *Journal of Experimental Psychology: Human Perception and Performance, 13*, 104-115.
- Gardner, D. (2007). Validating the construct of word in applied corpus-based vocabulary research: A critical survey. *Applied Linguistics, 28*(2), 241-265.
- Goswami, U., Ziegler, J. C., & Richardson, U. (2005). The effects of spelling consistency on phonological awareness: A comparison of English and German. *Journal of Experimental Child Psychology, 92*, 345-365.
- Grainger, J., & Dijkstra, T. (1992). On the representation and use of language information in bilinguals. In R. J. Harris (Ed.), *Cognitive processing in bilinguals* (pp. 207-220). Amsterdam: North-Holland.

- Hamada, M., & Koda, K. (2008). Influence of first language orthographic experience on second language decoding and word learning. *Language Learning*, 58(1), 1-31.
- Hamada, M., & Koda, K. (2010). The role of phonological decoding in second language word-meaning inference. *Applied Linguistics*, 31(4), 513-531.
- Hayashi, Y., & Murphy, V. (2011). An investigation of morphological awareness in Japanese learners of English. *Language Learning Journal*, 39(1), 105-120.
- Henderson, L. (1982). *Orthography and word recognition in reading*. London: Academic Press.
- Jarmulowicz, L., Hay, S. E., Taran, V. L., & Ethington, C. A. (2008). Fitting derivational morphophonology into a developmental model of reading. *Reading and Writing*, 21, 275-297.
- Jiang, N. (2000). Lexical representation and development in a second language. *Applied Linguistics*, 21, 47-77.
- Katz, L., & Frost, R. (1992). Reading in different orthographies: The orthographic depth hypothesis. In R. Frost & L. Katz (Eds), *Orthography, phonology, morphology, and meaning* (pp. 67-84). Amsterdam: North-Holland.
- Kerek, E., & Niemi, P. (2009). Russian orthography and learning to read. *Reading in a Foreign Language*, 21(1), 1-21.
- Koda, K. (1999). Development of L2 intraword orthographic sensitivity and decoding skills. *Modern Language Journal*, 83, 51-64.
- Koda, K. (2000). Cross-linguistic variations in L2 morphological awareness. *Applied Psycholinguistics*, 21(3), 297-320.
- Koda, K. (2008). Impact of prior literacy experience on learning to read in a second language. In K. Koda & A. M. Zehler (Eds), *Learning to read across languages: Cross-linguistic relationships in first- and second-language literacy development* (pp. 68-96). London: Routledge.

- Koda, K. (2013). Second language reading, scripts, and orthographies. In C. A. Chapelle (Ed.), *The encyclopedia of applied linguistics, Vol. 8* (pp. 5123-5130). West Sussex, UK: Wiley-Blackwell.
- Ku, Y., & Anderson, R. C. (2003). Development of morphological awareness in Chinese and English. *Reading and Writing: An Interdisciplinary Journal, 16*, 399-422.
- Kuo, L., & Anderson, R. C. (2006). Morphological awareness and learning to read: A cross-language perspective. *Educational Psychologist, 41*(3), 161-180.
- Landerl, K. (2000). Influences of orthographic consistency and reading instruction on the development of nonword reading skills. *European Journal of Psychology of Education, 3*, 239-257.
- Laufer, B. (2013). Second language word difficulty. In C. A. Chapelle (Ed.), *The encyclopedia of applied linguistics, Vol. 9* (pp. 5151-5156). West Sussex, UK: Wiley-Blackwell.
- Lin, C. C. (2015). L2 word learnability: A focus on written form of words. Unpublished Doctoral Thesis. The University of Sydney, Sydney, Australia.
- Mahony, D., Singson, M., & Mann, V. (2000). Reading ability and sensitivity to morphological relations. *Reading and Writing: An Interdisciplinary Journal, 12*, 191-218.
- McBride-Chang, C., Tardif, T., Cho, J., Shu, H., Fletcher, P., Stokes, S. F., Wong, A., & Leung, K. (2008). What's in a word? Morphological awareness and vocabulary knowledge in three languages. *Applied Psycholinguistics, 29*, 437-462.
- Minkova, D., & Stockwell, R. (2009). *English words: History and structure*. Cambridge, UK: Cambridge University Press.
- Mochizuki, M., & Aizawa, K. (2000). An affix acquisition order for EFL learners: An exploratory study. *System, 28*(2), 291-304.
- Muljani, D., Koda, K., & Moates, D. R. (1998). The development of word recognition in a second language. *Applied Psycholinguistics, 19*, 99-113.
- Nagy, W. E., Berninger, V. W., & Abbott, R. C. (2006). Contributions of morphology beyond phonology to literacy outcomes of upper

- elementary and middle-school students. *Journal of Educational Psychology, 98*, 134-147.
- Nagy, W. E., Diakidoy, I. N., & Anderson, R. C. (1993). The acquisition of morphology: Learning the contribution of suffixes to the meanings of derivatives. *Journal of Reading Behavior, 25*, 155-170.
- Nation, I. S. P. (2001). *Learning vocabulary in another language*. Cambridge, UK: Cambridge University Press.
- Nation, I. S. P. (2013). Vocabulary acquisition in second language acquisition. In C. A. Chapelle (Ed.), *The encyclopedia of applied linguistics, Vol. 10* (pp. 6102-6110). West Sussex, UK: Wiley-Blackwell.
- Olson, R., Forsberg, H., Wise, B., & Rack, J. (1994). Measurement of word recognition, orthographic, and phonological skills. In R. Lyons (Ed.), *Frames of reference for the assessment of learning disabilities* (pp. 243-277). Baltimore, MD: Paul H. Brookes.
- Paribakht, T. S., & Wesche, M. (1999). 'Incidental' vocabulary acquisition through reading: An introspective study. *Studies in Second Language Acquisition, 21*(2), 203-220.
- Patel, T. K., Snowling, M. J., & de Jong, P. (2004). A cross-linguistic comparison of children learning to read in English and Dutch. *Journal of Educational Psychology, 96*, 785-797.
- Pattamadilok, C., Morais, J., Ventura, P., & Kolinsky, R. (2007). The locus of the orthographic consistency effect in auditory word recognition: Further evidence from French. *Language & Cognitive Processes, 22*, 700-726.
- Perfetti, C. A. (1991). Representations and awareness in the acquisition of reading competence. In L. Rieben & C. Perfetti (Eds), *Learning to read: Basic research and its applications* (pp. 33-44). Hillsdale, NJ: Lawrence Erlbaum.
- Perfetti, C. A., Zhang, S., & Berent, I. (1992). Reading in English and Chinese: Evidence for a 'universal' phonological principle. In R. Frost & L. Katz (Eds), *Orthography, phonology, morphology and meaning* (pp. 227-248). Amsterdam: North-Holland.

- Perre, L., & Ziegler, J. C. (2008). On-line activation of orthography in spoken word recognition. *Brain Research, 1188*, 132-138.
- Plaut, D. C., McClelland, J. L., Seidenberg, M. S., & Patterson, K. (1996). Understanding normal and impaired word reading: Computational principles in quasi-regular domains. *Psychological Review, 103*, 56-115.
- Qian, D. D. (2004). Second language lexical inferencing: Preferences, perceptions and practices. In B. Laufer & P. Bogaards (Eds), *Vocabulary in a second language: Selection, acquisition and testing* (pp. 155-169). Amsterdam: John Benjamins.
- Ramirez, G., Chen, X., Geva, E., & Luo, Y. (2011). Morphological awareness and word reading in English language learners: Evidence from Spanish- and Chinese-speaking children. *Applied Psycholinguistics, 32*, 601-618.
- Read, J. (2000). *Assessing vocabulary*. New York: Cambridge University Press.
- Rey, A., Ziegler, J., & Jacobs, A. (2000). Graphemes are perceptual reading units. *Cognition, 75*, B1-B12.
- Ricketts, J., Bishop, D. V. M., Pimperton, H., & Nation, K. (2011). The role of self-teaching in learning orthographic and semantic aspects of new words. *Scientific Studies of Reading, 15*(1), 47-70.
- Ryan, A. (1997). Learning the orthographic form of L2 vocabulary: A receptive and a productive process. In N. Schmitt & M. McCarthy (Eds), *Vocabulary: Description, acquisition, and pedagogy* (pp. 181-198). Cambridge, UK: Cambridge University Press.
- Saiegh-Haddad, E., & Geva, E. (2008). Morphological awareness, phonological awareness, and reading in English-Arabic bilingual children. *Reading and Writing, 21*, 481-504.
- Schmitt, N., & Meara, P. (1997). Researching vocabulary through a word knowledge framework: Word associations and verbal suffixes. *Studies in Second Language Acquisition, 19*, 17-36.
- Schmitt, N., & Zimmerman, C. B. (2002). Derivative word forms: What do learners know? *TESOL Quarterly, 36*(2), 145-171.

- Seymour, P. H. K., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology, 94*, 143-174.
- Shankweiler, D., & Liberman, I. Y. (1972). Misreading: A search for causes. In J. F. Kavanagh & I. G. Mattingly (Eds), *Language by ear and by eye: The relationships between speech and reading* (pp. 293-317). Cambridge, MA: MIT Press.
- Shankweiler, D., & Lundquist, E. (1992). On the relations between learning to spell and learning to read. In R. Frost & L. Katz (Eds), *Orthography, phonology, morphology, and meaning* (pp. 179-192). Amsterdam: North-Holland.
- Share, D. L. (1995). Phonological recoding and self-teaching: Sine qua non of reading acquisition. *Cognition, 55*, 151-218.
- Share, D. L. (2004). Orthographic learning at a glance: On the time course and development onset of reading. *Journal of Experimental Child Psychology, 87*, 267-298.
- Simon, E., & Herreweghe, M. V. (2010). The relation between orthography and phonology from different angles: Insights from psycholinguistics and second language acquisition. *Language and Speech, 53*(3), 303-306.
- Strattman, K., & Hodson, B. W. (2005). Variables that influence decoding and spelling in beginning readers. *Child Language Teaching and Therapy, 21*(2), 165-190.
- Taft, M. (2001). Processing of orthographic structure by adults of different reading ability. *Language and Speech, 44*, 351-376.
- Tyler, M. D., & Burnham, D. (2006). Orthographic influences on phoneme deletion response times. *Quarterly Journal of Experimental Psychology, 59*, 2010-2031.
- Tyler, A., & Nagy, W. (1989). The acquisition of English derivational morphology. *Journal of Memory and Language, 28*, 649-667.
- Verhoeven, L., & Perfetti, C. (2003). Introduction to this special issue: The role of morphology in learning to read. *Scientific Studies of Reading, 7*(3), 209-217.

- Verhoeven, L., Schreuder, R., & Baayen, R. H. (2006). Learnability of graphotactic rules in visual word identification. *Learning and Instruction, 16*, 538-548.
- Verhoeven, L., & van Leeuwe, J. V. (2009). Modeling the growth of word-decoding skills: Evidence from Dutch. *Scientific Studies of Reading, 13*(3), 205-223.
- Wang, M., Koda, K., & Perfetti, C. A. (2003). Alphabetic and nonalphabetic L1 effects in English word identification: A comparison of Korean and Chinese English L2 learners. *Cognition, 87*, 129-149.
- Ward, J., & Chuenjundaeng, J. (2009). Suffix knowledge: Acquisition and applications. *System, 37*(3), 461-469.
- Westwood, P. S. (2008). *What teachers need to know about teaching methods*. Melbourne: Australian Council for Educational Research.
- Wimmer, H., & Goswami, U. (1994). The influence of orthographic consistency on reading development: Word recognition in English and German children. *Cognition, 51*, 91-103.
- Woore, R. (2010). Thinking aloud about L2 decoding: An exploration of the strategies used by beginner learners when pronouncing unfamiliar French words. *Language Learning Journal, 38*(1), 3-17.
- Wysocki, K., & Jenkins, J. R. (1987). Deriving word meanings through morphological generalization. *Reading Research Quarterly, 22*, 66-81.
- Zhang, D., & Koda, K. (2011). Contribution of morphological awareness and lexical inferencing ability to L2 vocabulary knowledge and reading comprehension among advanced EFL learners: Testing direct and indirect effects. *Reading and Writing, 25*, 1195-1216.
- Zhang, D., & Koda, K. (2013). Morphological awareness and reading comprehension in a foreign language: A study of young Chinese EFL learners. *System, 41*(4), 901-913.
- Ziegler, J. C., Petrova, A., & Ferrand, L. (2008). Feedback consistency effects in visual and auditory word recognition: Where

do we stand after more than a decade? *Journal of Experimental Psychology: Learning, Memory, & Cognition*, 34, 643-661.

Ziegler, J. C., Stone, G. O., & Jacobs, A. M. (1997). What's the pronunciation for *-ough* and the spelling for /u/? A database for computing feedforward and feedback inconsistency in English. *Behavior Research Method, Instruments, & Computers*, 29, 600-618.