

## 1 What Are the Key Concepts?

### 1.1 What Is Metalinguistic Awareness?

While it is generally agreed that metalinguistic awareness plays a critical role in language acquisition and development, the definition of metalinguistic awareness varies when researchers examine the link between metalinguistic awareness and *X*. Both cognitive and developmental scientists who study child first language (L1) development (e.g., Gombert, 1992; Tunmer et al., 1984) and applied linguists who study second language (L2) teaching and learning have referred to metalinguistic awareness as *explicit or conscious knowledge about language* (see a review in Roehr-Brackin, 2018). Researchers who are interested in the cognitive advantages of bilingualism/multilingualism over monolingualism have proposed that metalinguistic awareness involves two components – *the analytical ability to reflect upon and manipulate formal properties of language* and *the attentional control of the mental mechanism that operates language processing* (Bialystok, 2001; Bialystok & Ryan, 1985). Among researchers of L1 or L2 reading, metalinguistic awareness has been defined as “the ability to reflect on and manipulate the structural features of language” (Nagy, 2007, p. 53; Nagy & Anderson, 1995, p. 2; see also Kuo & Anderson, 2008). Learning to read is fundamentally metalinguistic because learners need to understand how the internal elements of a spoken word relate to units of graphic symbols. Reading in an L2, as compared to reading in an L1, can be even more metalinguistically demanding. Whereas successful adult L2 readers can be well cognizant of sharable metalinguistic resources between two languages and readily apply those resources to facilitate their L2 reading, this process can be a challenging task for children who are learning to read for the first time in an L2.

Metalinguistic awareness, in the context of reading acquisition, is often conceived of as a complex multidimensional and multifaceted construct, involving several related yet distinct components, ranging from segmental understanding (i.e., understanding that words can be segmented into smaller, functionally identifiable units), to structural sensitivity (i.e., the ability to isolate, blend, and combine segmental word information), to functional awareness (i.e., to apply structural understandings for functional purposes such as lexical inferencing)<sup>1</sup> (Ke et al., 2021; Koda & Miller, 2018; Zhang & Koda, 2013).

<sup>1</sup> *Lexical inferencing* is defined as “making informed guesses of the meaning of a word in light of all available linguistic cues in combination with the learners’ general knowledge of the world, [his/her] awareness of the co-text and [his/her] relevant linguistic knowledge” (Haastrup, 1991, p. 11). It has also been termed as *word learning*, *vocabulary learning*, *word meaning inferencing*, or *semantic gap filling* in the applied linguistics or reading literature.

Researchers have primarily examined three major facets of metalinguistic awareness: phonological awareness (the ability to reflect upon and manipulate phonological units in a language), orthographic awareness (the ability to form, store, and access orthographic representations of words), and morphological awareness (the ability to reflect on and manipulate the morphemic structures of words). Reading has been theorized as an interactive process of phonology, orthography, and morphology (Plaut et al., 1996; Seidenberg & McClelland, 1989). According to Perfetti (2003), the universal process of learning to read involves learning how one's writing system encodes one's spoken language at various levels, with phonology and morphology at the higher mapping level and inclusive of different languages, and orthography at the lower mapping level entailing more language-specific constraints. In regard to the relationship between metalinguistic awareness and L2 reading development, prior studies have been guided by various reading theories (e.g., the Psycholinguistic Grain Size Theory, Ziegler & Goswami, 2005; the Repertoire Theory of Literacy Development, Apel et al., 2004; Masterson & Apel, 2000; the Structural Sensitivity Theory, Kuo & Anderson, 2010; Universal Grammar of Reading, Perfetti, 2003) and models/frameworks of transfer (e.g., the Transfer Facilitation Model, Koda, 2005, 2008; An Interactive Framework of Bilingual Reading Development, Chung et al., 2019) (see Appendix S2 online: [osf.io/4z6mw](https://osf.io/4z6mw), which includes the coding of thirteen different frameworks/hypotheses/models/theories cited in the selected studies).

This Element is mainly guided by the Lexical Quality Hypothesis (Perfetti, 2007; Perfetti & Hart, 2002), the Repertoire Theory of Literacy Development (Apel et al., 2004; Masterson & Apel, 2000), and the Transfer Facilitation Model (Koda, 2005, 2008). According to the Lexical Quality Hypothesis (Perfetti, 2007; Perfetti & Hart, 2002), successful reading comprehension depends on high-quality lexical knowledge represented by orthography, phonology, morphosyntax, meaning, and the binding of these four features. While the Lexical Quality Hypothesis pertains to the causal relationship between lexical knowledge and reading comprehension and specifies the feature properties such as orthography, phonology, and morphosyntax, it does not directly address how metalinguistic awareness contributes to lexical knowledge or reading ability at the lexical level. In comparison, the Repertoire Theory of Literacy Development (Apel et al., 2004; Masterson & Apel, 2000) proposes explicitly that the development of word spelling and reading ability is subject to the application of phonological, orthographic, and morphological awareness, and provides specific guidance for reading instruction. In other words, teachers should not single out any facet of metalinguistic awareness, but rather concurrently promote different facets of metalinguistic awareness. Last but not least, the Transfer Facilitation Model (Koda, 2005, 2008) provides

important insights into cross-language transfer in L2 reading by treating metalinguistic awareness as a window of investigation, whereas other theories cited in previous research either were developed for L1 reading purposes only or examined a wide range of transferable reading subskills instead of focusing on metalinguistic awareness.

## 1.2 Reciprocal Development of Metalinguistic Awareness, Linguistic Knowledge, and Reading Competence

In this Element, we focus on the contributions from metalinguistic awareness to reading-related outcomes (e.g., word decoding, vocabulary knowledge, and reading comprehension) in L2 reading development. It is important, however, to acknowledge that metalinguistic awareness, reading competence (e.g., reading comprehension), and linguistic knowledge (e.g., vocabulary knowledge) (Koda, 2005; Nagy, 2007; Wagner & Meros, 2010)<sup>2</sup> are developmentally and reciprocally related. Nagy (2007) proposed that metalinguistic awareness is the causal mediator between vocabulary knowledge and reading comprehension (see also Zhang & Koda, 2018). To understand the mechanism underlying this *metalinguistic hypothesis*, four questions need to be answered: 1) How does metalinguistic awareness support reading comprehension? 2) How does vocabulary knowledge support reading comprehension? 3) How does metalinguistic awareness support vocabulary knowledge? and 4) What are the shared and unique contributions of different facets of metalinguistic awareness to reading development?

*How does metalinguistic awareness support reading comprehension?* Metalinguistic awareness plays at least two important roles in reading development. At the early stage, metalinguistic awareness enables learners to map the elements of spoken language onto the writing system and is thus fundamentally important for word decoding. Later, when learners develop more refined metalinguistic awareness, including deeper understandings of word-internal phonological, orthographic, and morphological structures, they can apply analytical approaches toward lexical inferencing during reading (Koda, 2005; Nagy et al., 2014). These two distinct yet related roles of metalinguistic awareness in reading development are supported by ample empirical evidence that uncovered indirect contributions of various facets of metalinguistic awareness to L1 or L2 reading comprehension via the mediation of word decoding (e.g., L1 Chinese: Li & Wu, 2015; Zhao et al., 2019; L1 English:

<sup>2</sup> Bialystok (2001) viewed metalinguistic ability and linguistic knowledge as two distinct constructs. She posited that metalinguistic ability should be measured at the abstract level without being instantiated in any particular language, whereas linguistic knowledge involves knowledge about a particular language.

Badian, 2001; Deacon et al., 2014; just to name a few)<sup>3</sup> or vocabulary knowledge (e.g., L2 Chinese: Ke & Koda, 2019; Leong et al., 2011; L2 English: Kieffer et al., 2013; Nassaji & Geva, 1999; Zhang & Koda, 2012; Zhang & Lin, 2021). Metalinguistic awareness has also been found to contribute directly to reading comprehension. For example, refined morphological awareness in English involves learners' sensitivity to the distributional properties of derived words, which account for a large proportion of words covered in academic English texts (Nagy & Townsend, 2012). This metalinguistic insight helps learners to use the syntactic cues provided by affixes and conduct sentence parsing in word-to-text integration (Levesque et al., 2021; Nagy, 2007; Perfetti & Stafura, 2014). Another rationale that supports the direct contribution of metalinguistic awareness to reading comprehension is that metalinguistic awareness is a subset of metacognition, and metacognition is important for reading comprehension (Nagy, 2007), perhaps more so for L2 learners (Bialystok & Ryan, 1985). According to Gombert (1992), metacognition refers to one's awareness and reflections about one's knowledge, experiences, and learning in general; metalinguistic awareness pertains to the reflections about one's *language* use and learning. In previous interventional studies of readers who have a heightened understanding of their own processes for acquiring knowledge (i.e., metacognition) and who are able to consider how and why language is used (i.e., metalinguistic awareness), findings have demonstrated that the introduction of explicit metacognitive and metalinguistic strategy instruction can positively influence reading comprehension (Williams & Atkins, 2009; Yuill, 2007; Zipke et al., 2009). The logic is that the language in written texts is more decontextualized than the language in spoken conversations; as a result, learners need to pay close attention to and analyze the language in written texts, reflect on the analyzed language, and control these cognitive processes during text reading.

*How does vocabulary knowledge support reading comprehension?* Vocabulary knowledge is often conceptualized to entail vocabulary size/breadth (how many words a learner knows; Nation, 2001) and vocabulary depth (how well a learner knows the words; Meara, 1996; Read, 1993, 2000). Both dimensions of vocabulary knowledge directly impact reading comprehension. Previous research indicates a very high vocabulary coverage rate for successful reading comprehension, ranging between 95 percent (Liu & Nation, 1985) and 98 percent (Hu & Nation, 2000; Nation, 2006; Schmitt et al., 2011). This clearly underscores the importance

<sup>3</sup> The citations here include previous research of two typologically distant writing systems: morphophonemic English and morphosyllabic Chinese. Instead of providing an exhaustive list of references, we have included recent empirical reading studies on English or Chinese either as the L1 or L2.

of vocabulary size in reading comprehension. Independent of the effect of vocabulary size, vocabulary depth makes an additional contribution to explaining variation in reading comprehension (e.g., Qian, 1998; Zhang & Yang, 2016). The direct effect of vocabulary knowledge on reading comprehension has also been supported by a meta-analysis of thirty-seven primary studies on the effects of vocabulary instruction in preK–12th graders whose L1 was English (Elleman et al., 2009). Elleman and colleagues (2009) identified significant, albeit small, improvement in vocabulary and reading comprehension outcomes as a result of vocabulary instruction. In addition, both vocabulary breadth and depth can indirectly contribute to reading comprehension via lexical inferencing while reading (Koda, 2005; Nassaji, 2003, 2006; Paribakht & Wesche, 1999; Qian, 2005). Successful lexical inferencing, either intentional or unintentional, will subsequently fill the semantic gaps of a learner's text representation and predict reading comprehension (Hatakeyama, 2012; Koda & Miller, 2018).

*How does metalinguistic awareness support vocabulary knowledge?* Metalinguistic awareness and vocabulary knowledge can serve as a bootstrapper for each other. For instance, McBride-Chang and colleagues (2008) tracked the developmental relationships between morphological awareness and vocabulary knowledge in preschoolers in three languages (Cantonese, Mandarin, and Korean) at two time points, and observed bidirectional bootstrapping effects: At Time 1 where vocabulary knowledge, phonological processing, and reasoning skills were controlled, morphological awareness predicted Time 2 vocabulary knowledge across languages; vocabulary knowledge also predicted subsequent morphological awareness, with Time 1 morphological awareness controlled. As reviewed earlier, morphological awareness and vocabulary knowledge are linked via lexical inferencing during reading comprehension. In other words, the ability to productively combine morphemes is viewed as an important skill in inferring meanings of new words (Wagner & Meros, 2010). Furthermore, vocabulary-depth knowledge acquired through formal instruction, such as knowledge of word roots, prefixes, and suffixes, serves as the foundation of morphological awareness (e.g., Zhang & Koda, 2018). One may doubt how the various facets of metalinguistic awareness jointly support vocabulary knowledge development. Regarding oral vocabulary knowledge acquisition, logic would suggest that both phonological and morphological awareness matter because learners need to associate spoken (phonological) forms of words with their meanings (morphemes) (e.g., McBride-Chang et al., 2005). Notably, orthographic awareness also plays a facilitative role in oral vocabulary knowledge acquisition in alphabetic and nonalphabetic languages as orthography has been found to boost learners' recall of novel new words verbally over no orthography in

previous quasi-experimental studies (e.g., Chinese in Zhang et al., 2020; English in Ricketts et al., 2009). One possible mechanism through which orthographic awareness supports oral vocabulary knowledge development can be explained by the Lexical Quality Hypothesis (Perfetti, 2007; Perfetti & Hart, 2002). Lexical representation that includes phonology, orthography, and semantics is considered of higher quality than a lexical representation that includes only phonological and semantic information (see also Salins et al., 2022). Regarding print vocabulary knowledge learning, according to Apel and colleagues (2004), phonological, orthographic, and morphological awareness are integral language components in print vocabulary acquisition measured by spelling. Apel and colleagues' position is also consistent with stage-based theories that view reading ability as developing from a *pre-alphabetic* phase to *semiphonetic*, *phonetic*, *within-word*, *syllable conjuncture*, and *derivational constancy* phases (Ehri, 2005; Templeton & Morris, 2000). Last but not least, as Nagy (2007) pointed out, many existing vocabulary knowledge measures are metalinguistic in nature (e.g., word definition skills, Kang, 2013; Ordóñez et al., 2002). Therefore, it is not surprising to find a strong association between metalinguistic awareness and vocabulary knowledge.

*What are the shared and unique contributions of different facets of metalinguistic awareness to reading development?* Phonological, orthographic, and morphological awareness are three interconnected yet distinct facets of metalinguistic awareness. In a recent structural equation modeling study, Tighe and colleagues (2019) explored a five-factor model of reading comprehension in struggling adult English readers and the interrelationships among these factors (i.e., phonological awareness, orthographic awareness, morphological awareness, word decoding, and vocabulary knowledge). Tighe and colleagues found that, as separate constructs, none of the metalinguistic skills emerged as uniquely predictive of reading comprehension; yet when the three facets of metalinguistic awareness were loaded to a second-order factor, the second-order factor was found to affect reading comprehension indirectly via word decoding and vocabulary knowledge. Although Tighe and colleagues' study focused on struggling adult readers instead of child L2 readers, it was among the first to provide empirical evidence supporting readers' dissociable use of the various facets of metalinguistic awareness for reading comprehension purposes. On the other hand, prior research of English reading comprehension in child and adult readers with or without reading disabilities has identified the unique contribution of morphological awareness to reading comprehension over and above phonological and orthographic awareness (e.g., Apel et al., 2012; Nagy et al., 2003; Tighe et al., 2019). Similar results have been reported in reading in L2 English (e.g., Bae & Joshi, 2018) or



a nonalphabetic L1 (e.g., Chinese in Zhang, 2017a). As Kirby and Bowers (2017) put it, morphology is the binding agent of phonological, orthographic, and semantic features of words. There are a few exceptions in L2 reading literature though, suggesting that, out of the three facets of metalinguistic awareness, either phonological awareness or orthographic awareness was among the most important predictors when word decoding instead of reading comprehension was treated as the target reading outcome (e.g., Zhang, 2017b; Zhou et al., 2018). For example, Zhou and colleagues observed that, for Southeast Asian immigrant children learning both English and Chinese as additional languages in Hong Kong primary schools, phonological awareness was the most important factor for word decoding in English, whereas orthographic and morphological awareness were both unique factors of word decoding in Chinese.

In sum, there are multiple direct and indirect paths that connect metalinguistic awareness, reading comprehension, and vocabulary knowledge together. A notable skill that helps to establish the reciprocal relationships between these three competencies (i.e., covarying with metalinguistic awareness, reading comprehension, and vocabulary knowledge) is *lexical inferencing* (see Koda, 2005; Nagy et al., 2014). In addition, previous research has also found word decoding to modulate the indirect contribution of metalinguistic awareness to reading comprehension (e.g., Badian, 2001; Deacon et al., 2014; Li & Wu, 2015; Zhang et al., 2020; Zhao et al., 2019). Last but not least, phonological, orthographic, and morphological awareness are the three most-researched facets of metalinguistic awareness in the literature, and they have been found to make both shared and unique contributions to reading development. Therefore, in the scoping review in Section 3, we aim to explore how and to what extent the various facets of metalinguistic awareness are related to word decoding, lexical inferencing, vocabulary knowledge, and reading comprehension, respectively, in prior L2 reading studies. The meta-analysis reported in Section 4, however, only covers the cross-language relationships between metalinguistic awareness and word decoding. Subskills of L2 reading such as lexical inferencing, vocabulary knowledge, and reading comprehension are not included in the meta-analysis. This is because, according to the scoping review results, prior studies that have measured phonological, orthographic, and morphological awareness simultaneously have focused on child L2 readers instead of adult L2 readers. In addition, word decoding was the most studied outcome; vocabulary knowledge and reading comprehension received far less attention; and little child L2 reading research examined lexical inferencing as a reading-related outcome.

### 1.3 Transfer Facilitation Effects of Metalinguistic Awareness Across Languages

In this Element, transfer is defined as “automatic activation of well-established first language competencies triggered by second language input” (Koda, 2008, p. 78). Facilitation is the bootstrapping consequence of applying available L1 resources, such as metalinguistic awareness, to L2 reading tasks (Genesee et al., 2006; Koda, 2005, 2008; Riches & Genesee, 2006). Various frameworks have been proposed to inform the understanding of transfer in applied linguistics research in general and in L2 reading research in particular. Examples include:

1. The Contrastive and Typological Framework (Lado, 1957), which views transfer as interference in the L2 due to L1 structural properties;
2. The Linguistic Interdependence Hypothesis, which distinguishes between cognitively and conceptually more and less demanding knowledge, and predicts the conditions under which the learner can demonstrate transfer of knowledge crosslinguistically (Cummins, 1979, 1981);
3. The Common Underlying Cognitive Processes Framework, which states that individual differences in L1 and L2 reading skills can be predicted by a common set of underlying cognitive constructs (such as phonological awareness and decoding; e.g., Geva & Ryan, 1993);
4. The Structural Sensitivity Theory (Kuo & Anderson, 2010), which postulates that “having access to two languages renders structural similarities and differences between languages more salient, thus allowing bilingual children to form representations of language structure at a more abstract level” (p. 365);
5. The Transfer Facilitation Model (Koda, 2005, 2008), which was briefly noted earlier.

Notably, Koda’s Transfer Facilitation Model is “the most elaborate theory of transfer to date” (Chung et al., 2019, p. 158). The model specifies that subskills are transferred in L2 reading acquisition rather than a set of L1 linguistic rules or a holistic construct (like L1 reading ability or L1 proficiency). More importantly, metalinguistic awareness is postulated as an important reading subskill that provides a window for crosslinguistic examinations. The Transfer Facilitation Model also highlights the nonvolitional and automatic nature of transfer, and provides predictions on multiple factors that affect transfer of subskills in L2 reading and the conditions for the transfer, including, for example, the joint influence of L1 metalinguistic awareness sophistication and L2 print input experience, as well as L1–L2 distance, which are in line with the following hypotheses on L2 reading.



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1. The Script Dependent Hypothesis (SDH) (Geva & Siegel, 2000) suggests that the development of reading component skills is a direct function of orthography transparency; thus, L2 reading efficiency is a direct function of L1 orthography.
2. The Linguistic Coding Differences/Deficit Hypothesis (LCDH) (Sparks et al., 1989, Sparks & Ganschow, 1991) indicates that students who do poorly in a foreign language may have language problems in their L1 that interfere with their ability to learn.
3. The Linguistic Threshold Hypothesis (Alderson, 1984) proposes that a threshold level of L2 linguistic knowledge/proficiency is required for L1 reading skills to transfer to L2.
4. The Short-Circuit Hypothesis (Clarke, 1980) proposes that L2 linguistic knowledge plays a more important role in predicting L2 reading ability development than does L1 reading ability (see also Bernhardt & Kamil, 1995; Carrell, 1991).

None of the four hypotheses mentioned above, however, attempts to specifically explain the transfer of metalinguistic awareness. Accordingly, no predictions have been made in them regarding to what extent L1 metalinguistic awareness transfers and facilitates L2 reading subskill development and under what conditions transfer facilitation occurs. In contrast, Koda (2008) provided four pertinent contentions:

1. Shared metalinguistic awareness (e.g., phonological awareness), once developed in one language, is readily available in the early stage of learning to read in another.
2. Language-specific metalinguistic awareness (e.g., orthographic and morphological awareness) reflects the specific ways in which language elements are graphically encoded in the writing system. When transferred, language-specific metalinguistic awareness, closely attuned to L1 properties, promotes the development of corresponding metalinguistic awareness and reading subskills in L2.
3. When transferred, L1 metalinguistic awareness competencies, reflecting L1 properties, are adjusted through print experience in L2. The degree of adjustment as well as the amount of L2 print experience are influenced by L1–L2 distance (i.e., how closely related L1 and L2 are).
4. The resulting L2 metalinguistic awareness and L2 reading subskills vary systematically in learners with diverse L1 backgrounds.

Since the Transfer Facilitation Model was first proposed by Koda (2005), it has been widely tested in empirical studies (for reviews, see Koda & Ke, 2018;

Koda & Reddy, 2008). The central tenet of the model, which underscores a facilitative transfer effect of L1 metalinguistic awareness, is consistent with the broad conceptualizations of L1 providing resources for L2 reading (Genesee et al., 2006). In addition, the association between L1 and L2 metalinguistic awareness as predicted by the model has been supported by substantial empirical studies on child or adult L2 readers across different linguistic and educational settings (e.g., American university learners of Chinese as a foreign language, Ke & Koda, 2017; American university learners of Chinese as a heritage language, Zhang & Koda, 2021; Chinese heritage children in the United States, Koda et al., 2014; college-level Chinese students who learned English in the United States, Li & Koda, 2022; Chinese children reading English as a foreign language in mainland China, Zhang & Koda, 2013; Japanese university learners of English as a foreign language, Koda & Miller, 2018; Kanada-speaking children learning to read English in India, Reddy & Koda, 2013; and multilingual children in Singapore, Zhang, 2016; Zhang & Ke, 2019), as well as a small number of meta-analytic studies (e.g., Jeon & Yamashita, 2014; Ke et al., 2021; Melby-Lervåg & Lervåg, 2011). Consequently, we have adopted this model to guide our reviews and meta-analysis in the rest of this Element.

In what follows, we first review the findings of five previous meta-analytic studies that are related to (but nonetheless distinct from) our meta-analysis (Section 2). We then provide a scoping review of empirical studies on metalinguistic awareness and L2 reading (Section 3). In Section 4, we present our meta-analysis of intralingual and interlingual correlations of phonological, orthographic, and morphological awareness with word decoding in L2 readers.

## 2 Evidence from Previous Meta-Analytic and Critical Reviews

### 2.1 Review Inclusion Criteria

Five meta-analytic studies (i.e., Jeon & Yamashita, 2014; Ke et al., 2021; Melby-Lervåg & Lervåg, 2011; Míguez-Álvarez et al., 2021; Ruan et al., 2018) have been included in the review in this section (as shown in Table 1) because they (1) examined the correlation between at least one facet of metalinguistic awareness (i.e., phonological, orthographic, or morphological awareness) and one reading-related outcome (e.g., word decoding, vocabulary knowledge, or reading comprehension) and (2) either focused on bilingual readers (Jeon & Yamashita, 2014; Ke et al., 2021; Melby-Lervåg & Lervåg, 2011) or both monolingual and bilingual readers (Míguez-Álvarez et al., 2021), or adopted a crosslinguistic perspective comparing correlational relationship(s)