# What is phonological awareness in L2?

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## ARTICLE INFO

## ABSTRACT

Phonological awareness is widely recognized as an important component of L2 reading. Phonological awareness is also considered a primarily metalinguistic skill not affected by the individual's L2 language proficiency, or by L1-L2 linguistic distance. The current paper takes a different perspective on L2 phonological awareness. It argues that L2 phonological awareness is affected by L2 language-specific factors, and that these factors may be as equally implicated in phonological awareness in L2 as the metalinguistic insight that words may be broken down into phonological units – often considered the hallmark of the phonological awareness construct. In support of this claim, we discuss two types of evidence. The first concerns significant differences between phonological awareness in L1 and L2, as well as a significant correlation between L2 oral language proficiency and phonological awareness in L2. The second concerns linguistic distance and the effect on L2 phonological awareness of phonological differences between L1 and L2. Both pieces of evidence are used to promote the argument that it is important to view phonological awareness in L2 as a two-dimensional construct encompassing a metalinguistic component, which may be metalinguistic in nature and language-independent, and a linguistic component which is language-specific and reflects phonological representations in L2.

## 1. Introduction

Phonological awareness is widely recognized as an important component of reading development and disability in L2 (August & Shanahan, 2006; Durgunoglu, 2002; Genesee & Geva, 2006; Geva & Wang, 2001; Gottardo, Yan, Siegel, & Wade-Woolley, 2001). None the less, the specific factors that go into phonological awareness in L2, and the specific mechanisms by which this ability affects L2 reading development are still unknown (Branum-Martin, Tao, Garnaat, Bunta, & Francis, 2012). The current paper attempts to shed light on these questions. It explores the role of two factors on phonological awareness in L2: L2 language ability and L1-L2 linguistic distance. It then uses evidence pertinent to these factors to argue that the contribution of phonological awareness to reading in L2 may not be limited to the metalinguistic component of the construct– the insight that words may be segmented into phonological units, but probably equally so to the sensitivity of phonological awareness tasks to phonological representations in L2.

Two questions have guided research into phonological awareness in L2. The first concerns the construct validity of L2 reading ability; specifically, whether L2 reading, and like L1 reading, encompasses phonological awareness as an essential component. Relatedly, the second question is the predictive utility of L2 phonological awareness in predicting L2 reading. That is, whether phonological awareness levels in young L2 learners can be reliably used to make valid inferences about the future development of L2 reading skill. This latter question is essential in the L2 context because many L2 learners embark on learning to read in L2 before they have developed proper oral language skills in this language. So, the question is whether limited oral language proficiency among L2 learners constrains the construct and predictive validity of phonological awareness tasks in the L2 context. Research addressing these

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questions revealed that, as in the L1 context, L2 reading development depends on phonological awareness. Moreover, L2 phonological awareness, and even when tested before proper L2 oral language skills have properly developed, is a reliable predictor of reading skill in L2 (e.g., Durgunoglu, 2002; Geva & Yaghoub-Zadeh, 2006; Geva, Yaghoub-Zadeh, & Schuster, 2000). Given these findings, as well as evidence showing that phonological awareness transfers between the two languages of bilingual children and language learners (Genesee & Geva, 2006), it was concluded that phonological awareness may be considered a language-independent metacognitive ability, or "part of one's general cognitive endowment.… [that is] largely independent of specific language experiences" (Genesee, Geva, Dressler, & Kamil, 2006, p. 159).

The current paper takes a different perspective on phonological awareness, especially when considered within the L2 context. It argues that phonological awareness in L2 is affected by two language-specific linguistic factors: a) L2 oral language proficiency; and b) linguistic distance between L1 and L2. It is argued that these factors may be as equally implicated in phonological awareness in L2 as the metalinguistic insight that words may be broken down into phonological units – often considered the hallmark of the phonological awareness construct. In support of this claim, we discuss two types evidence. The first concerns significant differences between phonological awareness in L1 and in L2, as well as a significant correlation between L2 oral language proficiency and phonological awareness in L2. The second concerns the effect on L2 phonological awareness of phonological differences between L1 and L2. Both pieces of evidence are used to promote the argument that it is important to view phonological awareness in L2 as a two-dimensional construct encompassing two components. The first is a metalinguistic component, which may be metacognitive in nature and language-independent. The second is a linguistic component that is language-specific and reflects phonological representations in L2. We also argue that, because linguistic distance between L1 and L2 varies with the phonological level concerned: phonemic, sub-syllabic, syllabic, the extent to which L2 phonological awareness may be language-specific, and distinct from phonological awareness in L1, might depend on the specific phonological unit targeted. Here, two factors are in order: a) whether the phonological unit targeted is a novel L2 phonological unit that is not available in L1 (Russak & Saiegh-Haddad, 2011), and b) whether the L2 phonological unit targeted does not coincide with a naturally developing perceptual phonetic segment in L1 (Morais, Alegria, & Content, 1987; Russak & Saiegh-Haddad, 2017; Saiegh-Haddad, Kogan, & Walters, 2010; Ziegler & Goswami, 2005).

## 2. The role of phonological representations in phonological awareness in L2

Phonological awareness is considered a primarily metalinguistic ability; It is defined as awareness of the phonological structure of spoken words and the ability to access and manipulate phonological structure. Yet, it is also agreed that phonological awareness might encompass a linguistic component too. For instance, McBride-Chang (1995) showed that speech perception as well as other linguistic factors (including phoneme identity and phoneme position) affected children's ability to access phonemes on several phonological awareness tasks in L1. These findings are in keeping with theories emphasizing the role of language in the emergence of phonological awareness (Elbro, 1996, 1998; Fowler, 1991; Goswami, 2000).

Few studies directly tested the effect of linguistic skills on phonological awareness in L1, and even fewer addressed this question in the L2 context. One way to address the linkage between language and phonological awareness is to study the effect of phonological representations in long-term memory. Katz (1986) tested this question in L1 among reading disabled children. Using a picture naming task, he asked if reading disability was associated with difficulty in retrieving familiar names from long term memory, and whether difficulty in naming was related to difficulty in making a phonological awareness decision on the name (such as phonological length). This study showed that poor reading was associated with greater naming difficulty. Also, naming errors bore different degrees of phonetic resemblance to the target suggesting a phonological representational difficulty. Most importantly, phonological awareness decisions were related to phonological representational quality; Phonological awareness in all readers significantly improved when only objects that were named accurately were considered. At the same time, the poor readers' performance remained significantly inferior to that of the better readers. These findings imply that phonological representations in long term memory affect phonological awareness, and that poor readers have a genuine difficulty in becoming aware of even accurately represented phonological structures. A similar conclusion was reached by Swan and Goswami (1997a, 1997b) who showed that when phonological representational quality is taken into account the phonological awareness deficits observed in dyslexic children, at least of large phonological units, disappear. This led to the conclusion that phonological awareness skills in dyslexics might depend *both* on the accuracy of the underlying phonological representation of stimulus lexical items and on the linguistic level of the required segmentation. Finally, Thomas and Senechal (2004) tested phonemic awareness for phonemes emerging late in the speech of children with articulation difficulties. This study showed that, even after articulation had normalized, late emerging phonemes were associated with lower levels of phonemic awareness. This finding suggests that weakened phonological representations might have a persistent and long-term effect on phonemic awareness.

The question of the relationship between quality of phonological representations and phonological awareness in the L2 context received less attention. L2 learners are dual language learners and they often develop a language (their L1), including a phonological system, before they embark on L2 language acquisition. Many L2 learners, especially in the foreign language learning context, are also older and often develop reading in L1 to various degrees of skill before they start reading in L2. Previously acquired L1 (Eckman, Elreyes, & Iverson, 2003) and previously acquired experience in the way a specific orthography maps oral language are expected to impact phonological processing and phonological awareness in L2 (e.g., Escudero & Wanrooij, 2010; Escudero, Simon, & Mulak, 2014).

Flege (1992) argues that adults and older children learning the sound system of a second language differ from young children acquiring the sound system of their native language in that they already possess a phonetic system for producing speech. As a result, he argues, "far more errors in production are likely to arise from the inappropriate use of previously acquired structures in L2

learning" (p. 556). It is also argued that previously established L1 phonological patterns can interfere with the establishment of L2 patterns, as a result, L2 learners might "decompose" an L2 word into the phonemic units (allophones, phonemes) of the LI, and "filter out" acoustic differences that are not phonemically relevant in the L1 (*cf* Flege, 1992). In line with these arguments, L2 sounds that do not have a counterpart in the LI inventory (novel phonological units), and familiar sounds occurring in an unfamiliar phonetic environment are harder to produce and they are heavily affected by transfer from L1 (Flege, 1995; Holm, Dodd, Stow, & Pert, 1999). L2 phonological contrasts that do not exist in the L1 of learners are also harder to discriminate (e.g., Kramer & Schell, 1982). Finally, focusing on pronunciation of L2 phonological contrasts, Eckman et al. (2003) in a recent examination of three L2 learning situations which involve the target language's having different phonemic contrasts from the native language (the native language has neither of two sounds which contrast in the target language, the native language includes just one of two sounds which contrast in the target language, the native language has both of the sounds in question but shows no contrast between them) conclude that "L2 phonology is a highly abstract enterprise parallel to the phonologies of primary languages, rather than – as has been assumed – a mere imitation of the target language's pronunciations" (p.170). In other words, interlanguage phonology is governed by abstract phonological principles with L1-L2 contrast introduced into L2 acquisition in a progressive and predictable way (Cutler, Weber, & Otake, 2006; Hayes-Harb & Masuda, 2008; Weber & Cutler, 2004). These findings have far reaching implications for understanding L2 phonological awareness among learners of different target languages, and with different L1 backgrounds.

In an effort to understand the role of language and phonological representations in phonological processing in L2, Wade-Woolley and Geva (2000) tested phonological sensitivity among young second grade English L1-Hebrew L2 children for the phonological contrast (/ts/versus/t/) which occurs productively in Hebrew but is phonotactically constrained in English and never constitutes the onset of syllables. To address this question, the researchers used a pseudo word recognition task. In this task, participants heard a pseudo word and were then asked to select, from an array of three choices that manipulated phonological and orthographic properties, the one that captured the stimulus pseudo word they had heard. As expected, the researchers found that children had more difficulty discriminating the target contrast in onset position. Moreover, they found that errors in auditory discrimination reflected difficulty in phonological representations (13.68% of trials) rather than in orthographic knowledge (3.23% of trials), and that phonological representational errors were particularly prevalent in less skilled readers. Similar results were reported in Wang and Geva' (2003) study of spelling in English L2 among Cantonese-speaking children. This study showed that auditory discrimination and spelling ability among English L2 children reflected difficulty in long-term memory representation for the English phonemes that are absent from Cantonese phonology, and that this difficulty was not orthographic in nature.

Difficulties with phonological representations in long-term memory may manifest as difficulties with the processing of verbal stimuli in working memory (Saiegh-Haddad & Ghawi-Dakwar, 2017). One task that taps into processing in working memory is the nonword repetition task, especially when long words are employed. This task shows a significant correlation with vocabulary size supporting mediation by lexical knowledge and linguistic representations in long term memory both in L1 (Conti-Ramsden, 2003; Hoff, Core, & Bridges, 2008; Rispens & Baker, 2012), and also in L2 (Dufva & Voeten, 1999; Engel de Abreu, Baldassi, Puglisi, & Befi-Lopes, 2013; Masoura & Gathercole, 1999; Service & Kohonen, 1995; Service, 1992). Further evidence for the effect of linguistic representation in long-term memory on phonological processing in working memory comes from evidence showing that nonword repetition is influenced by the wordlikeness of items (Gathercole, 1995, 2006); Wordlike nonwords are repeated more accurately than nonwordlike nonwords. This reflects the advantage for nonwords depicting phonological and lexical attributes characteristic of the participant's L1, such as stress patterns, morphological structure, phonotactic probabilities, etc. (Armon-Lotem & Chiat, 2012). Recently, this question was directly tested in nonword repetition in Arabic for novel versus non-novel phonological structures (Saiegh-Haddad & Ghawi-Dakwar, 2017). This study showed that young children find it more difficult to repeat novel nonwords, which encode phonemes that are not within their spoken vernacular. These findings suggest a strong association between phonological processing in working memory and phonological representations in long term memory, and are in keeping with Baddeley's (2003) multi-componential model of working. These findings are also in keeping with the Lexical Restructuring Model suggesting a positive influence of vocabulary size and phonological representational quality on phonological processing (Metsala, 1997a, 1997b, 1999; Metsala & Walley, 1998).

Phonological awareness tasks require phonological processing in working memory. The question that looms large is whether similar patterns of phonological representational effects will also emerge when phonological awareness is tested. This question is particularly relevant to phonological awareness in the L2 context. This is because the construction of linguistic representations in L2 is a slow and perpetuated process. Furthermore, this question is critical if a proper understanding of L2 phonological awareness and its role in L2 reading is to be attained. This paper is one step in this direction. In the next section, we discuss evidence in support of the role of two factors in phonological awareness in L2: L2 oral language proficiency and L1-L2 linguistic distance and argue that these effects reflect the effect of phonological representations in L2 on L2 phonological awareness.

Before we delve into the role of phonological representations on phonological awareness in L2, it is important to note that task-specific phonological operations might interact with phonological representations in shaping L2 phonological awareness patterns. Many studies of L2 phonological awareness use, so-called, 'deep' phonological awareness tasks (Mann & Wimmer, 2002; Stanovich, 1992) such as phoneme deletion. This may be judicious given evidence that deep phonological awareness tasks depend less on general language and speech development than 'shallow' tasks, like phoneme recognition tasks, or tasks tapping awareness of larger perceptual phonological units, such rhyming tasks in English (Foy & Mann, 2001; Mann & Foy, 2003). Yet, some L2 studies also employ shallow phonological awareness tasks and these might hinge heavily on previously established phonological patterns in L1 (Saiegh-Haddad, 2007b).

## 2.1. The effect of L2 oral language proficiency on phonological awareness in L2

To the extent that phonological awareness involves operation on an underlying representation of phonological structures, the integrity of the underlying representation in long term memory should affect the outcome of the phonological awareness operation (Fowler, 1991). Fundamental to this paper is the notion that the quality of the phonological representations in long-term memory is an important determinant of phonological awareness, and that deficient phonological representations might interfere with phonological awareness at all linguistic levels: phonemic, sub-syllabic, and syllabic.

Phonological representations in long term memory improve in quality hand in hand with development in oral language proficiency and with vocabulary expansion in particular (Metsala, 1999). Given the prolonged nature of L2 oral language proficiency development, an important question concerns the association between L2 oral language proficiency and L2 phonological awareness. A second related question concerns differences between phonological awareness in L1 and in L2 which may be reflective of differences in general language proficiency. Both questions follow from theories linking the role of long-term linguistic representations in the refinement of phonological representations (Metsala, 1999) and, in turn, in phonological processing (Baddeley, 2003; Dufva & Voeten, 1999; Katz, 1986; Service & Kohonen, 1995; Swan & Goswami, 1997a, 1997b).

While receiving rather minor theoretical treatment, significant differences between phonological awareness in L1 and in L2 have been reported in the literature. For instance, Branum-Martin et al. (2006) testing a large sample of English-Spanish bilingual children in the US showed that despite a high correlation between phonological awareness in the two languages of bilingual kindergarteners, indicating considerable overlap between the phonological awareness constructs in the two languages, the two constructs were statistically separable in each language. Similarly, Saiegh-Haddad and Geva (2008) report a significant difference between phonological awareness (using phoneme deletion) in English L1 and in Arabic L2 among English-Arabic school children (grades 3 through 6) in Canada in favor of English L1. This is so, despite the fact that the English syllable is phonologically more complex than the Arabic syllable and, hence, that the English phonological awareness task targeted more complex structures, such as phonemes within complex consonantal clusters. These results implied that weakened phonological awareness skills in L2 as against L1 might be attributed to lower L2 oral language skills.

In an examination of this question, Russak (2007) tested differences in phonological skills between Hebrew L1 and English L2 in a sample of sixty typical and reading disabled college Hebrew L1-English L2 students. A variety of parallel L1-L2 phonological processing and awareness tasks were constructed: Phoneme Recognition (PR), Auditory Discrimination (AD), Word Repetition (WR), Phoneme Isolation (PI), full Phoneme Segmentation (FS), and Phoneme Deletion (PD). The study showed consistently lower scores in English L2 than in Hebrew L1 on all tasks – excluded was the full phoneme segmentation task which turned out to be the most difficult among all tasks in both languages. These results are summarized in Fig. 1 below.

Another important finding emerging from this study was that not all phonological awareness tasks were correlated across languages. For instance, in the typical reader's group, only full phoneme segmentation, the hardest among all tasks used, correlated significantly across languages, $r(30) = 0.58$, $p < 0.001$, while phoneme isolation and phoneme deletion did not ($p > 0.05$). In contrast, in the reading disabled group, all three phonological awareness tasks were correlated across languages: Phoneme isolation: $r(30) = 0.67$, $p < 0.001$; Full phoneme segmentation: $r(30) = 0.47$, $p < 0.001$; and Phoneme deletion: $r(30) = 0.59$, $p. < 001$.

Addressing the same question of differences between phonological awareness in L1 and L2, Jayusy (2013) used a developmental cross-sectional design and tested phonological awareness in Arabic L1, in Hebrew L2, and in English L2 among 104 monolingual Arabic native speaking school graders (4th, 6th, and 8th grades). Parallel tasks of phonemic awareness (phoneme deletion) were developed in the three languages. Noteworthy that the Arabic speaking sample in this study started learning both Hebrew L2 and English L2 in the first grade (even though mandatory Hebrew teaching starts in the 3rd grade and English teaching starts in the 4th grade). The results showed significant correlations across the three languages Arabic L1-Hebrew L2, $r(101) = 0.91$, $p < 0.01$; Arabic L1- English L2, $r(101) = 0.89$, $p < 0.01$; Hebrew L2- English L2, $r(101) = 0.91$, $p < 0.01$. At the same time, analysis of variance showed a significant main effect of Language (Arabic L1, Hebrew L2, and English L2) as a within-subject factor, $F(4, 202) = 42.30$, $p. < 001$, and of Grade (4th, 6th, 8th) as a between-subject factor, $F(4, 202) = 8.08$, $p. < 0.001$. More importantly, a significant two-
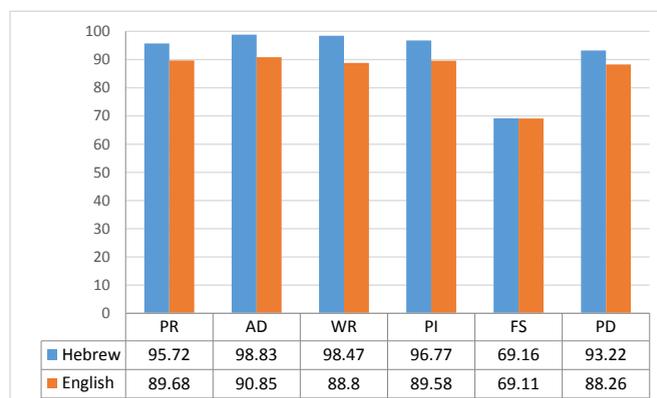


| | PR | AD | WR | PI | FS | PD |
|---|---|---|---|---|---|---|
| Hebrew | 95.72 | 98.83 | 98.47 | 96.77 | 69.16 | 93.22 |
| English | 89.68 | 90.85 | 88.8 | 89.58 | 69.11 | 88.26 |

**Fig. 1.** Percent correct scores on phonological tasks by language (Hebrew L1, English L2).

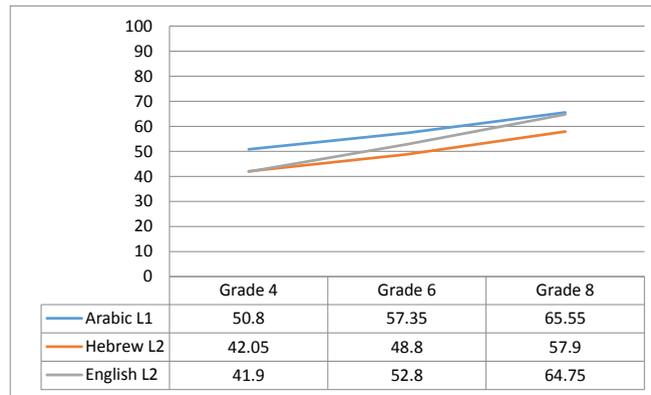| | Grade 4 | Grade 6 | Grade 8 |
|---|---|---|---|
| Arabic L1 | 50.8 | 57.35 | 65.55 |
| Hebrew L2 | 42.05 | 48.8 | 57.9 |
| English L2 | 41.9 | 52.8 | 64.75 |

**Fig. 2.** The interaction of language (Arabic, Hebrew, English) by grade (4th, 6th, 8th) on phoneme awareness.

way interaction of Language by Grade emerged, $F(4,202) = 3.97$, $p < 0.01$. Post hoc analysis indicated that in Arabic L1, the oldest 8th graders had significantly higher levels of phonological awareness than the youngest 4th graders, whereas no significant difference was observed between the 4th and 6th or the 6th and 8th graders, indicating a rather slow developmental progression in phonological awareness in Arabic L1. In contrast, in Hebrew L2 and in English L2, phonological awareness in the oldest 8th graders was significantly higher than both the 4th and the 6th graders, yet there was no significant difference between the 4th and 6th. Moreover, in the 4[t] Grade, children scored significantly higher in phonological awareness in Arabic L1 than in either Hebrew L2 or in English L2, yet this significant advantage for phonological awareness in L1 disappeared in the 6th grade when Hebrew L2 was compared with Arabic L1, and it emerged again in the 8th grade in favor of English and Arabic as against Hebrew. Fig. 2 shows the interaction of language by grade in the development of phonological awareness in the three languages tested.

One important observation emerging from the results depicted in Fig. 2 is the general advantage for phonological awareness in L1 as against L2, and regardless of whether the L2 is typologically similar to the L1 (Semitic Hebrew) or different (Germanic English). Another interesting observation is the observed slow yet significant developmental progression of phonological awareness in L1 and in L2, which was always in the expected direction with 4th graders performing more poorly than older kids. These differences in language status reflected as significantly higher scores in phonological awareness in L1 as against Hebrew L2 and English L2, at least in the younger group, might reflect general language ability differences. This inference receives support from the observed strong partial correlation (controlling for age) between a measure of L2 oral language ability (listening comprehension) and L2 phonological awareness in both Hebrew L2: $r(101) = 0.37$, $p < 0.001$ and English L2: $r (101) = 0.38$, $p. < 001$ (Jayusy, 2013; Saiegh-Haddad & Jayusy, 2016).

Another interesting finding emerging from this study pertains to the abrupt increase that children showed in phonological awareness in English L2 in the 8th grade, which exceeded that of Hebrew L2, and aligned with that of Arabic L1. This result might reflect the positive effect of the phoneme-based orthographic representation of alphabetic English on phoneme deletion as against the CV-based orthographic representation of Arabic and Hebrew *abjad* (Saiegh-Haddad & Henkin-Roitfarb, 2014; Saiegh-Haddad, 2007b, 2007a). The phoneme –based orthographic representation of English, and despite the irregular and unpredictable orthographic representation, appears to boost phonemic awareness in English. In contrast, the combined effect of a CV-based orthography and limited oral language proficiency appear to curtail awareness of phonemes in Hebrew L2.

Further evidence in support of the role of general language ability in L2 phonological awareness is reported in Russak and Saiegh-Haddad' (2011) study of adult Hebrew L1 learners of English L2. This study showed significant differences in phonological awareness between the two languages, in both typical and reading disabled learners, with higher scores in Hebrew L1 than in English L2: Phoneme isolation, $F(1, 58) = 12.97$, $p < 0.001$; Phoneme deletion, $F(1, 58) = 9.00$, $p < 0.001$. Moreover, this study showed a significant two-way interaction with the reading disabled group showing greater difficulty with phoneme deletion in L2 than the typical readers, $F(1, 58) = 6.23$, $p < 0.01$. Finally, while phonological operation on real word stimuli was consistently easier than phonological operations on pseudo words, $F (1, 58) = 14.60$, $p < 0.001$, phoneme isolation from pseudo words in English L2 was significantly harder than isolation from real words, $F(1, 58) = 6.72$, $p < 0.01$. Altogether, these findings imply that phonological representational quality affects phonological awareness in L2, and that phonological awareness difficulties in L2 might become more apparent when factors that undermine quality of phonological representations in long term memory co-occur. These factors include language status (L1 vs. L2), lexical status (real words vs. pseudo words), and reading ability (typical readers vs. reading disabled).

### 2.2. The effect of L1-L2 phonological distance on phonological awareness in L2

If phonological awareness in L2 involves an operation on a phonological representation in L2, and if constructing phonological representations in L2 is more challenging when the phonological unit under question is novel and not available in the L1, it is predicted that phonological awareness for novel phonological units will be harder than awareness of non-novel units. In the section below, we argue that L1-L2 differences in phonological structure, specifically in phonemic and in sub-syllabic structure, impacts accessibility to and awareness of L2 phonological units.

Languages vary in their phonemic inventories as well as in their syllabic and sub-syllabic structure. Hence, L1-L2 phonological differences are expected to affect phonological awareness in L2. This question was studied in the context of Arabic diglossia (Ferguson, 1959), a bilectal or semi-bilingual context in which children first acquire Spoken Arabic (SpA) as the language of everyday speech and later, around school age, they acquire Standard Arabic (StA) as the language of reading and writing. Importantly, the two language varieties are phonologically distant with some phonemes used only in StA but not in the spoken vernaculars (Saiegh-Haddad & Henkin-Roitfarb, 2014). The question addressed in this research was whether children find StA phonemes, which are not within their spoken vernacular, harder to access than SpA phonemes. Relatedly, whether operation on phonemes embedded within StA syllables and StA lexical items would be harder. The results showed that, even when pronunciation accuracy of the target phonemes was controlled, StA phonemes were significantly harder for elementary school children to access on both initial and final phoneme isolation tasks than SpA phonemes (Saiegh-Haddad, 2003, 2004). This effect was found to have external cross-dialectal validity (Saiegh-Haddad, 2007a). In other words, when awareness of the same set of phonemes was compared in two spoken Arabic dialects, they were found to be significantly more difficult only in the dialect in which they were not part of the children's SpA vernacular. Moreover, this factor, referred to as the *Linguistic Affiliation Constraint* (Saiegh-Haddad, 2007a) was found to be functional even when phoneme recognition tasks, which do not require phonological production, were used (Saiegh-Haddad, Levin, Hende, & Ziv, 2011). Finally, StA phonemes were found to be significantly harder for young kindergarten children to access when they were embedded within StA syllables (Saiegh-Haddad, 2003), and within StA words (Saiegh-Haddad, 2004). Two sources were stipulated for the difficulty that children have in accessing StA as against SpA phonemes: phonological representation in long term memory versus phonological processing. Testing these two hypotheses through controlled manipulation of distractors showed that difficulty with StA phonemes may be better explained as a result of low-quality phonological representations for StA structures in long term memory, rather than as a result of phonological processing (Saiegh-Haddad et al., 2011).

Russak and Saiegh-Haddad (2011) and Russak (2007) tested the same question of the role of phonological representations on phonological awareness among Hebrew L1 college students learning English as L2. A variety of phonological processing tasks were constructed that manipulated the linguistic affiliation of phonemes within words: English novel versus non-novel phonemes. The results of the study extended the *Linguistic Affiliation Constraint* to the L2 context (Saiegh-Haddad, 2007a) and showed that English L2 novel phonemes were significantly harder for college students to access on a variety of phonological tasks: Phoneme Recognition (PR), Auditory Discrimination (AD), Word Repetition (WR), Phoneme Isolation (PI), full Phoneme Segmentation (PS), except on the Phoneme Deletion task (PD) in which the target novel phoneme was to be deleted. These results are summarized in Fig. 3 below.

L1-L2 phonological contrasts are not limited to the phonemic inventories of the two languages but extend to the internal structure of the syllable. The effect of the internal structure of the syllable on phonemic awareness showed that awareness of phonemes in different languages is impacted by the position that the phoneme occupies within the syllable and by the internal structure of the syllable in that language (e.g., Caravolas & Landerl, 2010). A great deal of the research in this area was guided by the *rime-cohesion hypothesis*. According to this hypothesis, syllables are composed of phonemes structured hierarchically into two constituents: the onset; the initial consonant(s); and the rime (vowel–consonant [VC]), the nucleus vowel *with* the coda of any following consonant(s). The linguistic cohesiveness of the rime in English has acquired distributional evidence, with studies showing particularly close statistical dependencies between these units (e.g., De Cara & Goswami, 2002; Luce & Pisoni, 1998; Treiman & Kessler, 1995). Similarly, psycholinguistic evidence has shown that English speaking children and adults have a tendency to break syllables at the boundary between the onset and the rime. Finally, English speakers were found to have greater difficulty segmenting rime–coda (final) phonemes than onset (initial) phonemes, and cluster phonemes than singleton phonemes (e.g., Treiman, 1983, 1985, 1988; Bruck & Treiman, 1990; Treiman & Zukowski, 1991). These patterns have been replicated in several languages suggesting universal validity (Caravolas & Bruck, 1993; Caravolas & Landerl, 2010; González & García, 1995).

Recent studies, however, began to cast doubt on the universality of the onset–rime structure (Geudens & Sandra, 2003; Geudens, Sandra, & van den Broek, 2004; Saiegh-Haddad, 2007a, 2007b; Share & Blum, 2005). Of particular interest for the current discussion is research consistently showing that Arabic speaking children, and unlike English speakers, find initial phonemes more difficult to isolate than final phonemes, supporting hence a body-coda CV-C rather than an onset-rime C-CV structure. Also, convergent evidence
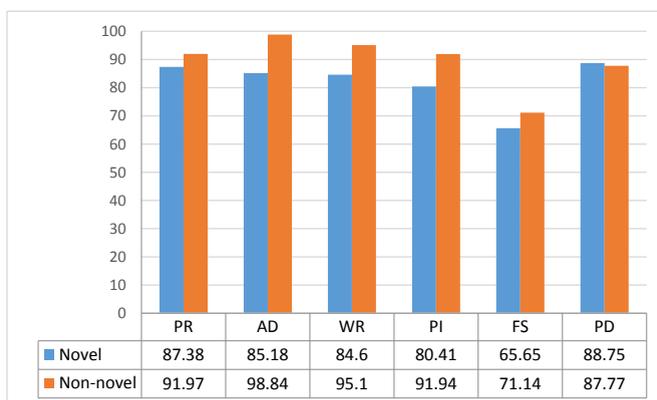


| | PR | AD | WR | PI | FS | PD |
|---|---|---|---|---|---|---|
| ■ Novel | 87.38 | 85.18 | 84.6 | 80.41 | 65.65 | 88.75 |
| ■ Non-novel | 91.97 | 98.84 | 95.1 | 91.94 | 71.14 | 87.77 |

**Fig. 3.** Phonological processing for English L2 novel versus non-novel phonemes.

suggesting a particularly strong cohesion of the CV unit in Arabic as reflected in the finding that isolating an initial consonant from a CV unit is harder than isolating it even from a cluster (Saiegh-Haddad, 2004, 2007a, 2003). Similar evidence was also reported in Hebrew (Saiegh-Haddad, 2007b; Share & Blum, 2005). These findings have implications for phonological awareness in L2 because they imply that L1-L2 differences in the internal structure of the syllable might result in differences in the facility with which phonemes and sub-syllabic units may be accessed in L2.

To address this question, we recently tested sub-syllabic and phonemic awareness in Hebrew and Russian preliterate mono-linguals in Israel and Russia, respectively, as well as in the two languages of early sequential Russian L1-Hebew L2 bilinguals in Israel (Kogan & Saiegh-Haddad, submitted). Using unstructured CVC syllable splitting tasks, structured CVC syllable splitting (onset-rime and body-coda), as well, as phoneme isolation tasks (initial and final) from CVC stimuli, we found that the CV unit was a particularly cohesive sub-syllabic phonological unit in both Hebrew L1 and Russian L1, and that it was particularly cohesive in Hebrew L2 among this group of Russian L1 bilingual children. This was reflected in the following findings: a) in all three language groups, unstructured syllable splitting showed a very strong tendency for splitting CVC syllables at the boundary between the body CV and the final coda consonant, b) Across all groups, body-coda splitting was significantly easier than onset-rime splitting, and c) Across all groups, final phoneme isolation was easier than initial phoneme isolation. Because Hebrew and Russian both favor a body-coda structure, it was not possible in this study to ascertain the effect of L1 sub-syllabic structure on phonological awareness in L2.

English and Hebrew depict two different sub-syllabic structures, onset-rime versus body-coda, respectively. This language combination allows then an examination of the role of L1-L2 differences in sub-syllabic structure on phonological awareness in L2. In the following study, we used structured syllable splitting (onset-rime versus body-coda), and phoneme isolation (initial versus final) tasks to address this question in the two languages of English L1 - Hebrew L2 bilinguals (Iverson, 2017; Iverson & Saiegh-Haddad, submitted). The performance of bilinguals was compared to two monolingual groups: English L1 speakers in the US and Hebrew L1 speakers in Israel. Fig. 4 below summarizes the performance of the three groups on the structured onset-rime (rime) and body-coda (body) syllable splitting tasks.

As may be seen from Fig. 4, the English monolinguals, and in accordance with earlier research, find onset-rime splitting significantly easier than body-coda splitting. This clearly contrasts with the Hebrew monolingual group who find the body-coda division easier (Saiegh-Haddad, 2007b; Share & Blum, 2005). More importantly, the results showed a clear effect of the L1 sub-syllabic structure on the bilingual children's phonological awareness in L2. Interestingly, the bilingual group's phonological awareness patterns, (who are sequential bilinguals with English as the first acquired language and Hebrew as the second language acquired in the general community) in both languages mimics that of Hebrew monolinguals; they show greater facility with final phonemes and with the CV body as against initial phonemes and the VC rime.

Whereas a key principle in conducting proper research is isolating factors so that their unique effect may be understood, in authentic phonological awareness tasks several linguistic factors converge, and this can have a strong impact on phonological processing. In the next study, we tested the independent and interactive effect of a number of linguistic factors believed to undermine phonological representations and impact phonemic awareness. These factors included position of the phoneme within the syllable, phoneme novelty, word lexical status, and language status. We asked Hebrew L1 speakers to isolate initial novel and non-novel phonemes from singleton and clustered contexts, and from real and pseudo words, in Hebrew L1 and in English L2 (Russak, 2007). As argued earlier, previous research has shown that the CV unit is particularly cohesive unit in Hebrew (Saiegh-Haddad, 2007b; Share & Blum, 2005). Earlier research has also shown that the CV unit may be the most cohesive with the stripping of a consonant from within the CV unit more difficult than the segmentation of any other consonant outside of this core-CV unit (Chen, 2011; Saiegh-Haddad et al., 2010). Given these insights, it was predicted that Hebrew L1 speakers would find initial phoneme isolation in Hebrew L1 and in English L2 CVC words and pseudo words harder than that from CCVC words and pseudo words. These predictions were generally confirmed; Initial phoneme isolation from a CVC stimulus was harder than that from a cluster in CCVC stimuli, and more so in pseudo words and in English L2. These results are depicted in Fig. 5 below.

The results depicted in Fig. 5 imply that the internal sub-syllabic structure of the syllable in L1 shapes patterns of phonological awareness in L2. As such, phonological units that are not naturally available in the L1 phonological system, such as initial phonemes
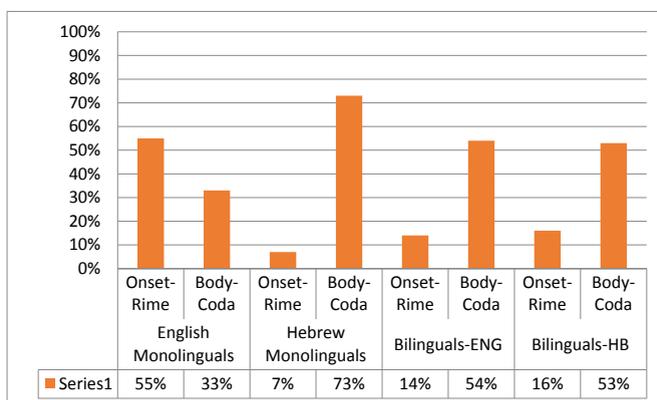


| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Onset-Rime | Body-Coda | Onset-Rime | Body-Coda | Onset-Rime | Body-Coda | Onset-Rime | Body-Coda |
| English Monolinguals | | Hebrew Monolinguals | | Bilinguals-ENG | | Bilinguals-HB | |
| 55% | 33% | 7% | 73% | 14% | 54% | 16% | 53% |

Fig. 4. Onset-rime awareness and body-coda awareness among monolingual Russian, monolingual Hebrew and bilingual children in English and Hebrew.
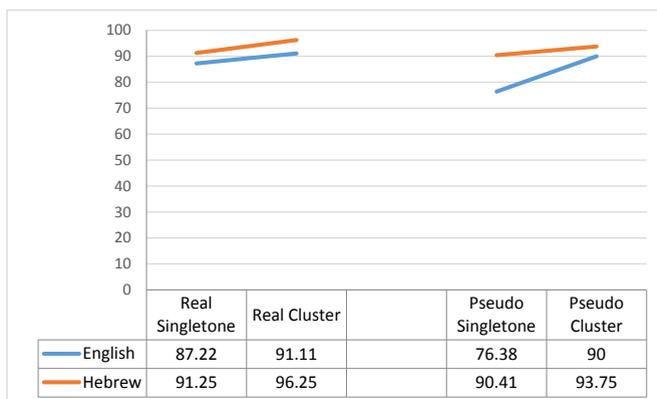
**Fig. 5.** Initial phoneme isolation by language (English, Hebrew), linguistic context (singleton, cluster), and lexical status (real, pseudo).

| | Real Singletone | Real Cluster | | Pseudo Singletone | Pseudo Cluster |
|---|---|---|---|---|---|
| English | 87.22 | 91.11 | | 76.38 | 90 |
| Hebrew | 91.25 | 96.25 | | 90.41 | 93.75 |

within CV units for Hebrew L1 speakers, are harder for them to access in L2. Moreover, these units are harder to access when they are embedded within pseudo words than real words, and especially in L2. Note that the sample in this study consisted of college students who are skilled in reading Hebrew L1, an *abjad* with a CV-based orthography. Therefore, the results might also reflect the effect of the CV-based orthography of the L1 combined with the effect of the CV-based phonology (Koda, 2008). Irrespective of the source of the CV-based phonological splitting tendency, the results show that the sub-syllabic structure of L1 has long lasting effects on phonological awareness in L2, and that this effect becomes apparent in the analysis of L2 pseudo words whose phonological representation is less stable than real words.

With respect to the effect of novelty, an interesting interaction of novelty (novel, non-novel) by context (singleton, clustered) by group (typical readers, reading disabled) on L2 phonological awareness emerged, which highlighted the role on L2 phonological awareness of the confluence of factors undermining phonological representations: reading disability, language status, lexical status, novelty, and sub-syllabic structure. In other words, while both typical and reading disabled participants found L2 novel phonemes harder to isolate than non-novel phonemes (Russak & Saiegh-Haddad, 2011), reading disabled found novel L2 phoneme in singleton contexts particularly more challenging than clustered phonemes. This interaction is illustrated in Fig. 6 below.

It is important to note that the nature of the phonological awareness task might interact with sub-syllabic phonological representations in affecting patterns of L2 phonological awareness. For instance, some so-called 'shallow' phonological awareness tasks (Stanovich, 1992), such as phoneme isolation, might be more sensitive to phonological representational quality than 'deep' tasks, such as phoneme deletion or full phoneme segmentation tasks; Deep phonological awareness tasks might require more explicit metalinguistic awareness than shallow tasks, therefore the effect of this factor might override the effect on task performance of phonological representations. In contrast, shallow phonological awareness tasks might tap into awareness of phonetic segments that develop naturally as perceptual units and are available for implicit awareness, such as the onset and rime in English or the body and the coda in Hebrew and Arabic, and might therefore be more sensitive to phonological representational quality than to metalinguistic awareness. In support of this, Saiegh-Haddad (2007b) tested phoneme recognition and phoneme isolation in Hebrew-speaking preliterate children and found that only phoneme segmentation was sensitive to the internal sub-syllabic structure of the Hebrew syllable, whereas phoneme recognition was not. Further research is required that explores the cognitive-linguistic operations that the different phonological awareness tasks targeting different linguistic units require. This will inform the degree to which the outcome of a given task might be expected to hinge upon language representations versus metalinguistic awareness and, in turn, the extent to
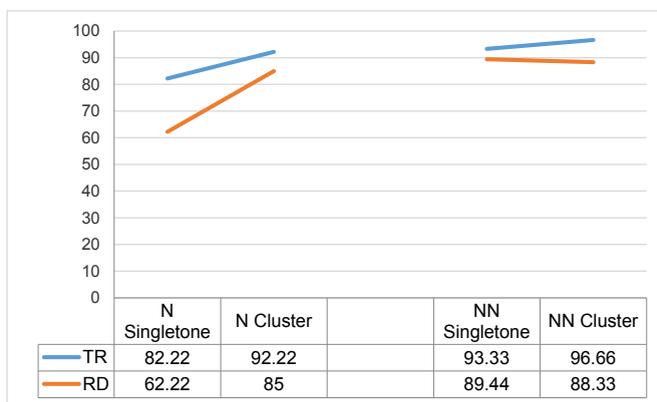


| | N Singletone | N Cluster | | NN Singletone | NN Cluster |
|---|---|---|---|---|---|
| TR | 82.22 | 92.22 | | 93.33 | 96.66 |
| RD | 62.22 | 85 | | 89.44 | 88.33 |

**Fig. 6.** Interaction of novelty (novel N, non-novel NN) by linguistic context (singleton, cluster) by group (typical readers TR, reading disabled RD) on phoneme isolation in English L2.

which L2 phonological awareness task performance might be expected to diverge from performance on the same task in L1.

Evidence supporting the argument that task characteristics might interact with the effect of the L1 sub-syllabic structure in shaping phonological awareness patterns in L2 comes from a recent study which analyzed the errors adult Hebrew L1 learners make on a full phoneme segmentation task in English L2. This study did not show a general advantage for initial consonants within CVC as against CCVC words. However, an analysis of errors showed a clear tendency for the creation and the preservation of CV units within words endorsing the effect of the CV-C body-coda sub-syllabic structure on phonological segmentation in English L2 (Russak & Saiegh-Haddad, 2017).

## 3. Conclusion

This chapter brings home the idea that phonological awareness in L2 is not a purely metalinguistic operation or "part of one's general cognitive endowment.… [that is] largely independent of specific language experiences" (Genesee et al., 2006, p. 159). Instead, phonological awareness in L2 is heavily impacted by phonological representations in long term memory and hence by oral language ability and by phonological distance between L1 and L2. Two sets of evidence were used to support this argument. One pertained to the relationship between L2 oral language proficiency and phonological awareness in L2, as well as differences between phonological awareness in L1 and L2 that may be attributed to differences in oral language skills. The second is evidence showing that phonological awareness in L2 is affected by L1-L2 phonological distance, specifically by whether the phonological units that candidates are asked to operate on are novel and not available in their L1 phonological system, and whether these units do not coincide with phonetic segments that are naturally accessed in L1. These data underscore the primary role of linguistic factors in phonological awareness in L2 and imply that this construct may be more accurately captured as a two-dimensional construct with phonological representations in long term memory as a critical component, besides the meta-cognitive metalinguistic component.

The idea that phonological awareness in L2 is a two-dimensional construct has important educational implications. One implication pertains to L2 phonological awareness instruction and assessment. It implies that phonological awareness is not an all-or-none phenomenon. In turn, helping L2 learners develop phonological awareness requires, not only helping them achieve the metalinguistic insight that words may be decomposed into phonological units, but also the ability to represent L2 phonological units accurately. Achieving the latter requires that teachers train learners in building up and accessing these representations, as in using oral drilling and auditory discrimination tasks. In contrast, achieving the former requires that teachers train learners in developing meta-phonological insights, as in providing practice in phonological analysis and synthesis. Relatedly, phonological awareness errors among L2 learners must be evaluated qualitatively in order to determine the source of the error: a metalinguistic or a representational difficulty. Note that if L2 learners have a representational difficulty, this difficulty will manifest as difficulty with the acquisition of other literacy related skills in L2 besides phonological awareness, such as learning grapheme-phoneme correspondence rules, word decoding, and word spelling (Saiegh-Haddad & Everatt, 2017).

## Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jneuroling.2017.11.001.

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