Morphology and Reading Skills in Arabic-Speaking Syrian Refugee Children

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Abstract

Limited research has been conducted on the literacy skills of Arabic-speaking refugee children. This study investigated the concurrent and longitudinal role(s) of morphological awareness in Arabic word reading and reading comprehension. A total of 75 Syrian refugee children aged 6-13 years resettled in Canada were administered measures of nonverbal reasoning, vocabulary, phonological awareness, morphological awareness, word reading and reading comprehension at two points in time separated by one year. Hierarchical regression analyses, controlling for age, cognitive abilities (verbal and nonverbal), and phonological awareness indicated that morphological awareness was related to word reading and reading comprehension concurrently and longitudinally. Results are interpreted in the context of the current sample and the orthographic and linguistic features of Arabic. Implications for future research, assessment, and instruction are discussed.

Key words: Morphological production, word reading, reading comprehension, refugee children, Arabic

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Morphology, a core component of language, has received an increasing amount of attention in literacy research and instruction. Morphemes are the smallest meaningful units of words. Morphological awareness entails the ability to analyze words into their constituent morphemes (roots or bases, prefixes, and suffixes) to construct meaning (Carlisle, 1995). A growing body of research has shown that morphological awareness contributes to literacy skills in Semitic languages such as Hebrew and Arabic (Ravid, & Malenky, 2001; Tibi & Kirby, 2017, 2019; Tibi et al., 2019; Vaknin-Nusbaum et al., 2016). Although the role of morphological awareness in literacy has been investigated in Arabic-speaking children, very few studies have focused on refugee children who are Arabic speakers.

The Syrian war alone displaced more than six million refugees (UN, 2021), 90% of whom are native Arabic speakers (Refugees from Syria, 2014). Refugee children face many unique challenges in language and literacy development such as psychological trauma, interrupted schooling, and low socioeconomic status (SES) during the migration and resettlement process (Al Janaideh et al., 2020; Hadfield et al., 2017; Soto-Corominas et al., 2020). Since 2015, more than 73,000 Syrian refugees have settled in Canada (Government of Canada, 2021). Aside from learning the language of the host country, Syrian refugee children have the task of maintaining and developing language and literacy skills in their first language (L1) in a minority environment. Given the challenges faced by refugee children in developing language and literacy skills, there is an urgent need for research in this population. In this study, we examined the concurrent and longitudinal effects of morphological awareness on word reading and reading comprehension in Arabic among school-age Syrian refugee children in Canada.

Arabic Language and Orthography

Arabic is a Semitic language characterized by an abjad orthography composed of 28 consonantal letters (Daniels, 1992). Two of these letters (w and y) serve dual functions as either long vowels or consonants. When these two letters function as consonants, they are articulated as /w/ and /j/; when they function as long vowels, they are pronounced as /u:/ and /i:/, respectively. Arabic has three long vowels (a:, u:, i:) and three corresponding short vowels (a, u, i). It should be noted that the long vowels are fully represented in the orthography, whereas the short vowels are represented by diacritic marks (e.g., ◌ً, ◌ٌ, ◌ٍ) added to the words in some but not all texts. For example, children's books and religious texts always include diacritics (vowelized texts), whereas newspaper texts appear without diacritics. Because Arabic orthography is characterized by homography, the addition of short vowels/diacritics enhances reading accuracy (Abu-Rabia, 1996; Abu-Rabia & Abu-Rahmoun, 2012) and comprehension (Abu-Rabia, 1999). Arabic orthography is also characterized by allography, a process that changes the shape of individual letters depending on whether a letter connects to the following letter or not. This ligaturing process occurs for 22 of the 28 letters. Allography constitutes an additional form of letter knowledge and increases orthographic depth (Share & Daniels, 2015; Tibi & Kirby, 2018; Tibi et al., 2021).

Another characteristic of the Arabic language lies in its dense morphology which includes both linear and nonlinear morphological processes (Boudelaa et al., 2001; Tibi et al., 2020). Morphology is linear in that one morpheme (prefix or suffix) is added after the other in a sequential manner (e.g., "lesson" /dars / +/a:n/ "dual marker suffix" = /darsa:n/ which means "two lessons"). Arabic allography allows for inflectional morphemes to be connected to the beginning or end of a word (e.g., the suffix /a:n/ attached to the word /kita:b/ "book" to yield /kita:ba:n/ "two books"). Therefore, polymorphemic words are common in Arabic with

morphemes interconnected by virtue of ligaturing (Tibi et al., 2020). Similarly, Arabic has some morphemes known as clitics. These morphemes express conjunctions and connect words to yield one-word (polymorphemic) utterances or phrases; (e.g., the Arabic word /bimadrasatihum/ is translated into English as the phrase “in their school”). Linear morphology is used for inflections and conveys grammatical information such as gender, number, person, and tense.

Arabic morphology is also characterized by its nonlinear morphological processes in which words are formed by interweaving two abstract bound morphemes (root + word pattern) in a noncontiguous manner. The root is consonantal and provides information about the semantic category, whereas the word pattern, mostly comprised of vowels, provides morpho-syntactic information. For example, the words /darasa// ‘to study’(verb), /madrasa/‘school’ (noun), and /mudarris/‘teacher’ (noun) are all derived from the same three-consonant root, /d.r.s/, whose general meaning is related to studying (e.g., to study, school, teacher). It is through this nonlinear process that the vast majority of Arabic words are formed. As a result, most Arabic words are minimally bimorphemic (Tibi & Kirby, 2017; Tibi et al., 2020).

The Arabic language is a diglossic language with two forms: A modern standard Arabic (MSA) form, and a Spoken Arabic (SA) form (Ibrahim, 2009). Modern Standard Arabic (MSA) is the literate form of Arabic and is used in writing and some formal speech situations. Colloquial forms of spoken Arabic (SA) are prevalent within and between Arabic-speaking countries. Linguistic differences between MSA and SA exist in all aspects of the language to varying degrees. For a detailed account of diglossia in Arabic, see Maamouri (1998) and Saiegh-Haddad and Henkin-Roitfarb (2014).

The Role of Morphological Awareness in Arabic Word Reading

According to the lexical quality hypothesis, word representation in the mental lexicon is multi-faceted, including phonology, semantics, orthography, and morpho-syntax (Perfetti, 2007; Perfetti & Hart, 2002). Morphological awareness enhances the specificity of phonological, semantic, and orthographic representations of a morphologically complex word, increases the understanding of its morpho-syntactic property (e.g., grammatical class), and creates stronger links among the different types of representations (Nagy et al., 2003). More precise representations and tighter connections among them, in turn, facilitate word reading (Carlisle, 2003; Nagy et al., 2013; Saiegh-Haddad & Taha, 2017).

Morphological awareness is particularly important for word reading in Arabic due to the dense morphological composition of the language (Boudelaa & Marslen-Wilson, 2001, 2015). All words derived from the same root are semantically related because the root provides the general meaning. Hence, root awareness enhances the lexical quality at the semantic level. Grammatical word patterns, on the other hand, provide stable and predictable orthographic and phonological units. Identifying these word patterns contributes to orthographic and phonological representations of word knowledge. For example, the word pattern "CV- - V-" denotes the grammatical category of an adverbial place and is pronounced in the same way for all words that follow the same pattern (e.g., /ma mal/ "lab", /marsam/ "studio; /maktab/ "office"; and /ma<u>s</u>na / "factory"). Moreover, attending to the regular orthographic patterns of inflectional morphemes (e.g., the suffix /t/ as a feminine singular third person marker) helps children recognize grammatical morphemes while decoding polymorphemic words (e.g., /darasat/ "she studied"; /rasamat/ "she drew").

Morphological awareness has been shown to predict word reading in children living in Arabic-speaking countries (Abu Ahmad et al., 2014; Abu-Rabia, 2007; Saiegh-Haddad & Taha,

2017; Tibi & Kirby, 2017, 2019; Tibi et al., 2019, 2020). For example, Abu-Rabia (2007) demonstrated that morphological awareness (identification and production) was significantly related to vowelized word reading in grades 3, 6, 9, and 12 in Israeli Arabic-speaking children. Tibi and colleagues (2020) investigated the effects of word-level characteristics (e.g., numbers of letters, syllables, morphemes, ligaturing, etc.) and individual differences in morphological awareness on vowelized word reading in grade three children in the United Arab Emirates. Both the number of morphemes as a word-level feature and morphological awareness as a child-level factor were found to be significant predictors of reading, highlighting the central role of morphology in Arabic reading. Finally, in a rare longitudinal study, Ahmad et al. (2014) observed that morphological awareness measured in kindergarten contributed to vowelized word reading in grade two among Arabic-speaking children in Israel. A limitation of the existing research, however, is that most of the studies did not control for other important literacy skills such as phonological awareness and vocabulary in the analyses.

To date, very few studies have examined the role of morphological awareness in word reading in Arabic-speaking children who reside in countries where Arabic is not the societal language (Gottardo et al., 2020; Saiegh-Haddad & Geva, 2008). These studies, all of which adopted a concurrent design, have produced somewhat inconsistent findings. For example, Saiegh-Haddad and Geva (2008) targeted bilingual children in grades 3-6 in an English-Arabic private school in Canada. The children did not speak Arabic at home and only started learning Arabic in school from kindergarten. The results showed that Arabic morphological awareness predicted word reading fluency, but not word reading accuracy, after controlling for oral language proficiency and phonological awareness. These researchers speculated that because vowelized Arabic was a transparent orthography, only phonological awareness was required for

word reading accuracy. However, previous studies on children living in Arabic-speaking countries found that morphological awareness was related to vowelized word reading (e.g., Ahmed et al., 2014), though none of the studies controlled for phonological awareness. Additionally, the nonsignificant finding in Saiegh-Haddad and Geva (2008) could be due to the small sample size (N = 43) or the children's low levels of Arabic proficiency.

To our knowledge, Gottardo et al. (2020) conducted the only study focused on refugee children. This concurrent study involved Syrian refugee children aged 6-13 who had been resettled in Canada for about two years. The results showed that Arabic morphological awareness, measured with a production task, was a unique predictor of vowelized word reading after controlling for age, nonverbal reasoning, vocabulary and phonological awareness, providing strong evidence that morphological awareness is related to literacy development among refugee children in a minority language setting. Extending Gottardo et al. (2020), the present study tested the same Syrian refugee children one year later. Thus, the first objective of the present study was to examine whether morphological awareness would predict word reading concurrently one year after Gottardo et al. (2020), and whether morphological awareness measured at the earlier time would predict subsequent word reading. We kept the same control variables for the concurrent analysis. For the longitudinal analysis, we also included the autoregressor (word reading at Time 1) to examine whether morphological awareness determines progress in word reading over time.

The Role of Morphological Awareness in Arabic Reading Comprehension

The second objective of the present study was to examine the concurrent and longitudinal role of morphological awareness in reading comprehension in Syrian refugee children. Theoretically speaking, morphological awareness is related to reading comprehension in multiple

ways (Nagy et al., 2006, 2013). First, as mentioned above, morphological awareness plays a key role in word recognition, which is an essential component of reading comprehension (e.g., Hoover & Gough, 1990; Gough & Tunmer, 1986). Second, morphological awareness allows children to access and remember the meanings of morphologically complex words based on roots and affixes (Kieffer & Lesaux, 2012; Nagy et al. 2013). With respect to Arabic, knowing the general meaning of a root helps children figure out the semantic category of any word derived from the root (Tibi et al., 2019). Deriving different words from the same root increases vocabulary breadth and depth, both of which are important for reading comprehension (e.g., Nagy et al., 2006; Sparks & Deacon, 2015). Third, morphological awareness helps children figure out the part of speech of a morphologically complex word and become sensitive to the grammatical role of the word in the context of sentences (Nagy et al., 2013). In Arabic, word patterns provide information about morpho-syntactic properties of words. For example, the word [l-jʔ -kol-o-na-ha] (ليأكلونها) ((they) to eat it), embedded in the root (ʔkl), signals future tense [l], plural marker [o], masculine gender [jʔ], and relative-object pronoun [ha].

The role of morphological awareness in Arabic reading comprehension has been well-documented in Arabic-speaking children (Abu-Rabia, 2007; Mahfoudi et al., 2010; Asadi et al., 2017; Layes et al., 2017; Tibi et al., 2019, Tibi & Kirby, 2019). For example, Mahfoudi et al. (2010) showed that written morphological production and segmentation measures were related to a timed cloze test of reading comprehension in Kuwaiti children in grades 3-6. The contributions remained significant after controlling for grade, gender, and phonological awareness. In a study involving Israeli Arabic-speaking children, Asadi, Khateb and Shany (2017) found that morphological awareness was a significant predictor of reading comprehension in grades 1-6 above the contributions of decoding and listening comprehension. In another study, Tibi and

Kirby (2019) observed that morphological awareness assessed by a wide range of morphological awareness tasks explained unique variances in text reading fluency and maze reading comprehension measures in grade 3 children above and beyond naming speed, working memory, phonological awareness, orthographic processing, and vocabulary. Further, when the participants were divided into good and poor decoders, morphological awareness remained as a significant predictor for both groups. Similar findings have been reported in longitudinal studies (Ahmad et al., 2014; Vaknin-Nusbaum & Saiegh-Haddad, 2020). For example, Vaknin-Nusbaum and Saiegh-Haddad (2020) showed that morphological awareness measured at the beginning of grade 2 predicted reading comprehension at the end of the school year in Arabic-speaking children after controlling for word reading. However, no previous studies have explored the contribution of morphological awareness to reading comprehension in Arabic native speakers who are refugees living in a minority language environment. The present study aimed to fill this gap by examining whether morphological awareness predicts reading comprehension in Syrian refugee children resettled in Canada concurrently at two time points separated by one year and whether morphological awareness measured at the earlier time point predicts subsequent reading comprehension after controlling for the earlier reading skills, including the autoregressor.

The Present Study

To recapitulate, the present study investigated the role of morphological awareness in word reading and reading comprehension in Arabic among Syrian refugee children resettled in Canada due to the Syrian civil war. As mentioned above, the children were assessed at two time points separated by one year. The first objective of the study was to examine the concurrent contribution of morphological awareness to word reading at each time point and the longitudinal

contribution of earlier morphological awareness to subsequent word reading. The second objective was to examine these concurrent and longitudinal relationships between morphological awareness and reading comprehension. For the first objective, we carried out hierarchical linear regressions to assess the unique contributions of morphological awareness to word reading after controlling for age, nonverbal reasoning, phonological awareness, and vocabulary. For the second objective, similar regressions were used with age, nonverbal reasoning, word reading and vocabulary as control variables. In further analyses, autoregressors were added to both sets of longitudinal regressions to explore whether morphological awareness predicts gains in the outcomes.

As mentioned earlier, a number of studies have shown that morphological awareness is related to vowelized word reading and reading comprehension in Arabic (Abu-Rabia, 2007; Asadi et al., 2017; Gottardo et al., 2020; Tibi & Kirby, 2017, 2019; Tibi et al., 2020). The majority of the studies, however, were conducted among Arabic-speaking children who resided in countries where Arabic was the societal or community language. Our study explored these relationships in a sample of Syrian refugee children living in Canada, a country where Arabic is a minority language and not the medium of instruction in public schools. To gain a good understanding of our sample, we conducted an one-hour interview with the mother of each participating child in Arabic using the questions in the Alberta Language Environment Questionnaire-4 (ALEQ-4; Paradis et al., 2020). We found that all Syrian refugee children spoke Arabic as the L1 and used the language exclusively more than 90% of the time at home. On the other hand, all children were attending public schools with English as the medium of instruction. While some children also attended heritage language programs in Arabic, the amount of instruction was typically no more than half a day per week. Most Syrian refugee children in our

sample came from disadvantaged socioeconomic (SES) backgrounds, with more than 40% of the parents reporting only obtaining primary school education. Other adverse factors resulted from their pre-immigration experience. About a quarter of the sample had interrupted schooling prior to arrival, and some parents and children suffered war-related trauma. It is therefore important to examine whether the findings of previous research can be extended to the Syrian refugee children in our sample who have experienced interrupted education.

To our knowledge, only two previous studies (Gottardo et al., 2020; Saiegh-Haddad & Geva, 2008) have been conducted in countries where Arabic was not the societal language. These studies provided contradictory results with respect to the relationship between morphological awareness and word reading. Saiegh-Haddad and Geva (2008) argued that morphological awareness was not required for vowelized word reading because Arabic is a shallow orthography in the presence of vowels. Gottardo et al. (2020), on other hand, demonstrated that morphological awareness explained unique variance in vowelized word reading concurrently after controlling for phonological awareness. The present study sought to clarify the nature of the relationship between morphological awareness and word reading. As for reading comprehension, we are unaware of any previous studies exploring the contribution of morphological awareness in Arabic outside of Arabic-speaking countries. However, given the strong relationships between morphological awareness and reading comprehension reported in previous studies after controlling for word-level and oral language skills, we expected to observe similar findings in Syrian refugee children in Canada.

Method

Participants

In response to the humanitarian crisis in Syria, Canada welcomed more than 25,000 Syrian refugees from 2015 to 2016 (Government of Canada, 2021). Our sample consisted of 96 Syrian refugee children from 50 families who were resettled in Canada during this period of time. These families lived in Toronto (n= 32 families, 60 children) and Waterloo (n= 18 families, 36 children), two cities in the province of Ontario. The majority of the Syrian refugee families (84%) were resettled through government-assisted refugee programs, and 16% of the families were sponsored by private citizens. The children were tested at two timepoints approximately one year apart. They were aged 6-13 years (46 boys, *M* age = 114.1 months, *SD* = 23.7, age range=72.0 - 161.0 months) at the first time point (Time 1). Among them, 23 children (12 boys, *M* age = 110.8 months, *SD* = 18.6, age range= 90.0 - 157.0 months) experienced interrupted education and did not receive any form of formal schooling before they arrived in Canada. Eight children dropped out of the study at the second time point (Time 2); another 12 students did not attempt the word reading and reading comprehension tasks at both timepoints. These children were removed from the study. In addition, one extreme outlier was identified in the morphological production task and removed from the analyses. The final sample size consisted of 75 children (35 boys, *M* age = 117.2 months, *SD* = 22.4, age range = 77.0 - 161.0 months) from 43 families (Toronto: 32 families, 59 children; Waterloo: 11 families, 16 children).

Demographic information was obtained from all mothers through the Alberta Language Environment Questionnaire-4 (ALEQ-4; Paradis et al., 2020), which was adapted from Paradis (2011) to specifically target Syrian refugee children . The questionnaire was presented to each mother in Arabic in a phone interview, which took approximately one hour. With respect to parent education, 46.7% of the mothers completed primary school education, 34.7% completed secondary education, and 18.6% completed university. For fathers, the percentages were 41.3%,

34.7% and 16.0%, respectively. The remaining 8.0% of the fathers did not provide information about their education. Arabic was reported as the L1 for all parents and children. About 69.0% (n = 52) of the children received Arabic schooling for 1- 48 months (*M*= 11.9 months) before their resettlement in Canada. By the time of the study, all the children had been enrolled in Canadian public schools where the language of instruction was English.

Parents reported on language and literacy environment richness at home on a 5-point scale (never/0 hours, a little/1-5 hours, regularly/5-10 hours, often/10-20 hours, and very often/20+ hours). With respect to speaking and listening activities in Arabic (e.g., watching TV shows, movies, YouTube, listening to music, singing, etc.), 4.0% reported never, 22.7 % reported a little, 46.7% reported regularly, 14.7% reported often, and 12.0% reported very often. With respect to reading and writing activities in Arabic (e.g., reading books for school or pleasure, visiting websites, messaging, emailing, engaging in social media such as Facebook, Instagram, and Snapchat, and completing homework), 70.7% reported never, 22.7% reported a little, 2.7% reported regularly, 2.7% often, and only 1.3% reported very often. When parents were asked the amount of time their children spent in Arabic heritage language classes per week, 46.7% reported never, 46.7% reported a little, 5.3% reported regularly, and 1% reported often. Finally, 70.7% of the parents reported having only 1-5 children's books in Arabic at home.

Measures

The children were first tested in the summer (June to August) of 2018 (Time 1) on nonverbal reasoning and language and literacy measures. All measures, including nonverbal reasoning, were administered in Arabic. The children received the same battery of language and literacy measures approximately 7 months later (Time 2). Non-verbal reasoning was only assessed at Time 1.

Nonverbal Reasoning. Two subtests of the Matrix Analogies Test (Naglieri, 1985), Reasoning by Analogy and Spatial Visualization, were administered at Time 1. For each item, the child was asked to choose one of six options that best completed the given matrix. The test was discontinued after four consecutive errors. Each subtest consisted of 16 items of increasing difficulty. A composite score was calculated by combining the two subtests. The Cronbach's alpha for both subtests combined was .87.

Vocabulary. Receptive vocabulary was assessed with the vocabulary subtest of the Arabic Language Assessment Battery (ALAB, Assadi et al., 2015). For each item, the experimenter orally presented a word and the child was asked to point to one of four pictures that best represented the word. This test had 2 practice items and a total of 73 items. The test was discontinued after the child failed eight consecutive items. The Cronbach's alpha was .86 at Time 1, and .92 at Time 2.

Phonological Awareness. Arabic phonological awareness was measured with an elision task adapted from Tibi (2016). The items were administered orally in increasing order of difficulty. Each child was asked to omit a syllable or a phoneme from spoken items to create a new word. For the first three test items, children were asked to repeat a two-syllable word and then delete one of its syllables [e.g., انطق الكلمة بدونَ (سماء) (سَ)). [sama ʔ], say the word without (s)]. For the remaining test items, the children were asked to repeat a word and then delete its initial [e.g., (آآث) انطق الكلمة بدون (ار)، . [ʔa:θa;r], say the word without (ʔa:)], medial [e.g., انطق الكلمة بدون ر(شَرق)،(شَمس)). [ʃrq], say the word without (r)], or final phonemes [e.g., انطق الكلمة بدون (س)). [ʃams], say the word without (s)]. This task consisted of 6 practice items, and 20 test items. Administration of the test was discontinued after three consecutive errors. The Cronbach's alpha for our sample was .80 for Time 1, and .93 for Time 2.

Morphological Production. Morphological awareness was measured with the morphological production subtest from the Arabic Language Assessment Battery (ALAB, Assadi et al. 2015). In each item, the child was orally presented with a root and was asked to derive as many words from the root as possible in 60 seconds. All items were real roots made up of three consonant letters [e.g.,(ب.ع.ل), (l.ʕ.b)]. The child's responses were audio-recorded for later scoring. The test consisted of two practice items and five test items. The total score was the number of words generated from all roots. The Cronbach's alphas for our sample for Time 1 and Time 2 were .97 and .96, respectively.

Word Reading. Arabic word reading was evaluated with a task created by Tibi (2016). At Time 1, the task consisted of 10 practice items and 90 vowelized words that gradually increased in difficulty (number of letters, syllables, and morphemes-see Tibi et al., 2020 for details). The child was asked to read each word aloud, and testing stopped when the child failed six consecutive items on the same page. Given that the word reading task was challenging to many children at Time 1, 10 letters of the Arabic alphabet were added to the beginning of the task at Time 2. Three letters were also added to the practice items. The child was asked to identify all 10 letters before they continued with the rest of the task. The Cronbach's α for our sample was .97 at Time 1, and .98 at Time 2.

Reading Comprehension. Arabic reading comprehension was assessed with a task that consisted of two components. The first component was a sentence reading task adapted from the ALAB (Assadi et al., 2015). There were two practice items and 10 test items. Each item contained three sentences and one picture. The child was asked to read the sentences and choose the one that best represented the picture. The second component was a passage reading task created by Mahfoudi (2010). In this part, the child read short passages that gradually increased in

difficulty and answered several multiple-choice questions related to each passage. Each question had four options. There were two practice and six test passages (three narrative and three expository passages), with a total of 32 questions. The child was given 25 minutes to complete both components. Given that many children were beginning readers and found the task challenging at Time 1, three practice items and nine test items were added at Time 2 to make the task easier. The additional items required children to silently read single words and short sentences and then point to the picture that best represented the meaning of a word or sentence among four options. All children were required to complete the nine new items before moving to the rest of the task. The Cronbach's α for our sample was .95 at Time 1, and .97 at Time 2.

Procedure

Each participant was individually assessed either at school or at home. All measures were administered in Arabic by trained research assistants who were native Arabic speakers. Each child received 2-3 testing sessions, and each testing session took approximately 45-60 minutes. All children were tested on nonverbal reasoning first, followed by vocabulary, word reading, and morphological production. Reading comprehension was the last measure to be administered.

Results

Table 1 presents the descriptive statistics for all measures across Time 1 and Time 2. All reported scores are raw scores and were used for the statistical analyses. All variables were checked for skewness and kurtosis and all values fell within the acceptable range (i.e., statistic/SE ± 3.29; Tabachnick & Fidell, 2007). A series of t-tests were conducted to compare the children's performance at Time 1 and Time 2. There was a statistically significant increase in vocabulary ($t = 3.53$, $p < .01$), phonological awareness ($t = 3.92$, $p < .001$), morphological

production ($t = 3.79$, $p < .001$), word reading[1] ($t = 2.99$, $p < .01$), and reading comprehension ($t = 2.23$, $p < .01$), between the two timepoints.

Bivariate correlations among all measures across both time points are presented in Table 2. The outcome variables, word reading and reading comprehension, were significantly associated with all other variables with correlations ranging from .46 to .94 (p <. 01). With respect to concurrent correlations, morphological production, word reading and reading comprehension were significantly correlated with all other variables at both Time 1 and Time 2. Longitudinally, Time 1 morphological production was significantly correlated with all variables at Time 2. It was highly correlated with both word reading (r =.83, p < .01) and reading comprehension (r = .89, p < .01) at Time 2.

Morphology and Word Reading

Hierarchical regression analyses were carried out to examine whether morphological production was a unique predictor of word reading at Time 1, Time 2 and longitudinally. For the concurrent Time 1 and Time 2 analyses, age and nonverbal reasoning were entered in the first step as control variables. Vocabulary, phonological awareness, and morphological production were entered in subsequent steps. Table 3 shows the results of the regression analyses. At Time 1, age and nonverbal reasoning in the first step, vocabulary in the second step, phonological awareness in the third step, and morphological production in the final step accounted for significant 45%, 7%, 10%, and 8% of the variance in word reading, respectively. Final beta weights indicated that morphological production was a unique significant predictor of word reading. Similarly, at Time 2, age, nonverbal reasoning, vocabulary, phonological awareness and

[1] T-tests between Time 1 word reading, and Time 2 word reading, as well as between Time 1 reading comprehension and Time 2 reading comprehension were calculated based on the shared items between Time 1 and Time 2.

morphological production each made a significant contribution to the prediction of word reading, accounting for 45%, 10%, 6%, and 8% of the variance, respectively. Final beta weights indicated that phonological awareness and morphological production were unique predictors of word reading. The final models explained 70% of the variance at Time 1, and 69% of the variance at Time 2.

Furthermore, we examined whether morphological production at Time 1 predicted word reading at Time 2. We conducted two separate regression analyses. The first model did not have an autoregressive control, whereas the second model had word reading at Time 1 as an autoregressor. Due to the strong correlation between word reading at Time 1 and Time 2, including the autoregressor enabled us to observe whether the morphological production task given at Time 1 predicted the gains in word reading between the two timepoints. In the first model (see Table 4), Time 1 age and nonverbal reasoning were entered in the first step as control variables. Time 1 vocabulary, phonological awareness, and morphological production were entered in subsequent steps. In the second model, Time 1 age and nonverbal reasoning were entered in the first step as control variables. Time 1 vocabulary and phonological awareness were entered in steps 2 and 3, followed by time 1 word reading (autoregressor) in step 4. Time 1 morphological production was entered in the final step so examine whether it would predict gains in word reading overtime.

In the model without the autoregressor control, Time 1 age, nonverbal reasoning, vocabulary, phonological awareness, and morphological production each made a significant contribution to Time 2 word reading, accounting for 42%, 8%, 19%, and 8% of the variance, respectively. Final beta weights indicated that Time 1 phonological awareness and morphological production were unique predictors of Time 2 word reading. The final model

explained 77% of the variance in word reading. In the model with the autoregressor control, word reading at Time 1 variables contributed 20% of the variance when it was entered after age, nonverbal reasoning, vocabulary, and phonological awareness. Morphological production, entered in the last step, still accounted for 1% of the variance. The final beta weight indicated that Time 1 phonological awareness, word reading and morphological production were unique predictors of Time 2 word reading. Remarkably, the final model explained 90% of the variance in word reading.

Morphology and Reading Comprehension

A series of hierarchical regressions were carried out to examine whether morphological production was a unique predictor of reading comprehension at Time 1, Time 2 and longitudinally. For the concurrent analyses, age and nonverbal reasoning were entered in the first step as control variables. Vocabulary, word reading, and morphological production were entered in subsequent steps. Table 5 shows the results of the concurrent regression analyses. At Time 1, age, nonverbal reasoning, vocabulary, and word reading accounted for 56%, 4%, and 20% of the variance in reading comprehension, respectively. The morphological production task did not contribute any additional variance when it was entered in the last step. Final beta weights indicated that age and word reading were unique predictors of reading comprehension. At Time 2, age, nonverbal reasoning, vocabulary, word reading and morphological production each made a significant contribution to reading comprehension, accounting for 48%, 4%, 34%, and 1% of the variance, respectively. Final beta weights indicated that age, word reading and morphological production were unique predictors of reading comprehension. The final models explained 80% of the variance at Time 1, and 87% of the variance at Time 2.

Furthermore, we examined whether morphological production at Time 1 predicted

reading comprehension at Time 2 in two longitudinal models, one without the autoregressor and another with the autoregressor. In the first model (Table 6), Time 1 age and nonverbal reasoning were entered in the first step as control variables. Time 1 vocabulary, word reading, and morphological production were entered in the next steps. In the second model (Table 6), Time 1 age and nonverbal reasoning were entered in the first step as control variables. Time 1 vocabulary and word reading were entered in steps 2 and 3. Time 1 reading comprehension (autoregressor) was entered in step 4. Time 1 morphological production was entered in the final step.

In the model without the autoregressor control, Time 1 age, vocabulary, word reading, and morphological production each made a significant contribution to the prediction of time 2 reading comprehension, accounting for 49%, 3%, 28%, and 1% of the variance respectively. Final beta weight indicated that age, word reading and morphological production were unique predictors of Time 2 reading comprehension. The final model explained 81% of the variance in reading comprehension. In the model with the autoregressor control, Time 1 reading comprehension contributed 1% of the variance in Time 2 reading comprehension. Morphological production, entered in the last step, also predicted 1% of the variance. The final beta weight indicated that Time 1 word reading and morphological production were unique predictors of Time 2 reading. The final model explained 82% of the variance in reading comprehension.

Discussion

The objectives of the current study were to investigate the contributions of morphological awareness to word reading and reading comprehension in school-age Arabic-speaking Syrian refugee children who were resettled in Canada. We assessed the children's morphological awareness with a production task that required them to generate inflected and derived words

from given roots, and we evaluated whether their performance on this task was related to word reading and reading comprehension concurrently and longitudinally. We were also interested in determining if morphological awareness accounted for unique variance in word reading and reading comprehension longitudinally above the contributions of autoregressive controls.

Generally speaking the Syrian refugee children in our sample were not strong readers of Arabic. A total of 12 children (12.5% of the original sample) were unable to read at Time 2, and were thus excluded from the data analyses. This is likely because some of the Syrian refugee children in our sample had interrupted schooling before they were resettled in Canada and all children received instruction only in English in public schools after resettlement, However, it is important to note that the remaining children made significant gains on all language and literacy measures from Time 1 to Time 2, suggesting that the majority of the Syrian refugee children were able to maintain and grow their L1 skills in a language minority setting. Given the positive trajectory of their Arabic development, it is not surprising that morphological awareness was related to word reading and reading comprehension both concurrently and longitudinally among Syrian refugee children. Moreover, the longitudinal relationships remained significant with the addition of the autoregressive controls of word reading and reading comprehension measured one year earlier. We address each of these regression findings below.

Our results showed that morphological awareness was a significant predictor of word reading at both Time 1 and Time 2 after controlling for age, nonverbal reasoning, vocabulary and phonological awareness. Assessing the children twice at one year apart allowed us to demonstrate that morphological awareness exerted a concurrent impact on word reading over time. Together with Gottardo et al. (2020), these results corroborate the findings of previous studies conducted in Arabic-speaking countries (e.g., Abu-Rabia, 2007; Tibi & Kirby, 2017,

2019, 2020; Tibi et al, 2019) and extend them to a vulnerable refugee group residing in Canada. This body of research underscores the central role of morphology in Arabic reading regardless of children's language learning environment and SES. Consistent with the lexical quality hypothesis (Perfetti, 2007), our study suggests that Arabic-speaking children rely on morphological awareness to access the phonological, semantic, orthographic, and morpho-syntactic information embedded in roots and grammatical word patterns. Activating and connecting these representations facilitates word reading in Arabic whereby morphology plays a critical role in the formation of its words.

Our results also demonstrated that morphological awareness assessed at Time 1 was related to word reading longitudinally after controlling for age, nonverbal reasoning, vocabulary and phonological awareness. Notably, the prediction remained significant after the addition of the autoregressor control of Time 1 word reading. Longitudinal results with the autoregressor control have important developmental implications (e.g., Lam, Chen, & Deacon, 2020). In the present study, the results indicate that early morphological awareness is associated with gains in the acquisition of word reading skills overtime. This temporal order points to a potential causal relationship between morphological awareness and word reading in Arabic, though any causal link needs to be substantiated by intervention studies. Another notable finding is that the word reading model with the autoregressor explained 89% of the variance in word reading, suggesting that this model successfully captures key skills required for word reading development in Syrian refugee children. Thus, it seems that drawing explicit attention to the structure of Arabic words, as well as the morphemic units within words (roots and affixes), are effective ways to facilitate accurate word reading.

Only a few previous studies have controlled for phonological awareness in studying the role of morphological awareness in word reading in Arabic (Gottardo et al., 2020; Saiegh-Haddad & Geva, 2008; Tibi & Kirby, 2019). Our findings align with Gottardo et al. (2020) but deviate from Saiegh-Haddad and Geva (2008). Given the small sample size in the Saiegh-Haddad and Geva (2008) study, it is possible that they did not have sufficient power to detect significant findings. Another possible explanation is that the majority of the children in Saiegh-Haddad and Geva (2008) were only exposed to Arabic in the school setting and none of them were native speakers, so their language and literacy skills developed more slowly. Nevertheless, morphological awareness was found to predict word reading fluency beyond phonological awareness in this study, suggesting that morphological awareness facilitates at least some aspects of word-level reading. In fact, there is increasing evidence that morphological awareness plays a significant role in word reading in transparent orthographies with complex morphology, such as Spanish (Ramirez, et al., 2010), Finnish (e.g., Müller & Brady, 2001) and Hebrew (Vaknin-Nusbaum et al., 2016). In the case of Arabic, characteristics such as allography, ligaturing and diglossia add to orthographic depth despite regular grapheme-phoneme correspondences. As such, morphological awareness is required to read vowelized Arabic beyond the contribution of phonological awareness.

With respect to reading comprehension, the concurrent contributions of morphological awareness changed over time. Morphological awareness did not predict reading comprehension at Time 1 but this prediction became significant at Time 2. Given that the children improved in all language and literacy skills between Time 1 and Time 2 (morphological awareness, word reading, vocabulary, and reading comprehension), these results suggest that morphological awareness plays an increasingly important role in reading comprehension as children become

more proficient readers in Arabic. Similar patterns have been reported in other languages, such as English (Carlisle & Fleming, 2003) and Greek (Manolitsis et al., 2017). Thus, as children move up in grade levels and encounter more complex texts, they draw more heavily on morphological awareness to aid comprehension. However, it should be noted that our sample covered a wide range of ages and grade levels (6-13 years at Time 1). Because children of different ages did not face the same curriculum requirements or make the same gains in literacy skills over the same period of time, the patterns of the results observed in the present study need to be interpreted with caution and replicated by future research with more homogeneous samples in terms of age and grade level.

Regressions examining longitudinal relationships showed that morphological awareness measured at Time 1 accounted for unique variance in reading comprehension at Time 2 after controlling for age, nonverbal reasoning, vocabulary and word reading. Similar to the results on word reading, the prediction of reading comprehension from morphological awareness also survived the addition of the autoregressor control, indicating that early morphological awareness is responsible for children's progress in reading comprehension over time. The longitudinal results, as well as the concurrent results at Time 2, are in line with those reported by previous studies involving children who resided in Arabic-speaking countries/communities (Abu-Ahmad et al., 2014; Vaknin- Nusbaum & Saiegh-Haddad, 2020). By extending the findings of previous research to Syrian refugee children resettled in Canada, the present study provides convincing evidence that morphological awareness is critical for reading comprehension in Arabic for children from different language learning environments and diverse SES backgrounds.

There are a number of reasons why morphological awareness contributes to reading comprehension in Arabic. First, morphological awareness contributes to reading comprehension

through word reading and vocabulary, two skills central for reading comprehension (e.g., Gough & Tunmer 1986). Morphological awareness facilitates word reading by enhancing lexical quality because identifying the root and grammatical word pattern of a word helps children access and integrate the phonological, semantic, orthographic, and morphosyntactic information embedded in these morphemic units. With respect to vocabulary, morphological awareness enables children to infer word meanings through roots and understand how words sharing the same root are semantically related. Because we controlled for the effects of word reading and vocabulary in our regressions, our results indicate that morphological awareness also contributes to reading comprehension through morphological decoding and/or morphological analysis. The former refers to parsing a morphologically complex word into its constituent morphemes to pronounce it correctly, whereas the latter entails inferring the meaning of the word from these morphemes (e.g., Deacon et al., 2017; Levesque et al., 2017). Additionally, children may use the morphosyntactic information contained in affixes to enhance sentence comprehension. Thus, children who are morphologically aware actively apply strategies to identify the pronunciation, meaning and the part of speech of a novel word they encounter while reading (Nagyet al., 2014). It is remarkable that despite their overall low levels of literacy, Syrian refugee children are able to apply some or all of the strategies in Arabic.

The findings of the present study must be interpreted with caution due to the relatively small sample size studied and the fact that the participants' data were averaged across several grade levels. These findings should be replicated with a larger sample allowing for separate analyses by grade. Further, we examined only root awareness through morphological production in the present study. Future research could consider assessing children's ability to decompose morphologically complex words, or target specific aspects of Arabic morphology such as

inflectional morphology. Because Arabic is a morphologically dense language in which morphological awareness consists of many interrelated dimensions (Tibi & Kirby, 2017; Tibi et al., 2020), it is important to investigate the roles of multiple morphological skills (oral vs. written or production vs. judgement or word-vs. sentence level processes) in literacy development among refugee children. Finally, it is worth noting that the ALEQ-4 questionnaire (Paradis et al., 2020) might not have captured the many ways that refugee families interact as part of daily life. Although the information obtained through the questionnaire indicated relatively few language and literacy activities in Arabic, the children in our sample improved on all measures between the two time points. Thus, researchers must design more sensitive tools for refugee children in future studies.

In sum, the present study not only provides strong evidence for the role of morphological awareness in Arabic word reading and reading comprehension but also extends previous findings to refugee children resettled in an Arabic language minority environment. Our results suggest that all students, regardless of vulnerability or learning environment, may benefit from explicit training on morphological awareness from a young age. It is vital that educators utilize this knowledge in literacy instruction. For example, Arabic language teachers can purposefully design lessons to draw children's attention to roots in target words, and emphasize the shared semantics between words derived from the same root focusing on morphological analysis similar to morphological analysis mechanism as proposed in the framework by Levesque et al. (2020). Educators can also encourage children to decompose polymorphemic words into morphemic units (morphological decoding), or prompt children to derive as many words as possible from the same root (morphological family). These morphological activities are expected to enhance students' understanding of the structure, meaning, and grammatical function of words, as well as

increase vocabulary breadth, depth and reading comprehension. There is no doubt that explicit and systematic instruction in morphological skills is particularly important for vulnerable populations such as Syrian refugee children.

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Table 1.

Descriptive Statistics for All Measures (N=75)

Variable (No. of Items)	Time 1			Time 2		
	M	SD	Min.-Max.	M	SD	Min.-Max.
Age (months)	117.22	22.49	77-161	127.36	22.36	86-170
NVR (32)	8.36	5.83	0-23			
VOCAB (73)	44.58	11.52	17-66	47.81	12.18	11-71
PA (20)	11.28	6.75	0-20	13.25	6.06	1-20
MP	27.44	15.09	0-65	31.41	15.08	4-81
WR (90/100)	26.69	28.88	0-88	39.04	29.28	2-97
RC (41/50)	12.04	11.97	0-36	21.30	14.16	1-46

Note. NVR = Nonverbal Reasoning. VOCAB = Vocabulary. PA = Phonological Awareness. WR = Word Reading. MP = Morphological Production. RC = Reading Comprehension. *$p < .05$, **$p < .01$, ***$p < .001$.

Table 2.

Correlation Matrix Among all Variables

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. T1-Age	-												
2. T1-NVR	.43**	-											
3. T1-VOCAB	.54**	.49**	-										
4. T1-PA	.42**	.45**	.54**	-									
5. T1-WR	.63**	.48**	.63**	.67**	-								
6. T1-MP	.64**	.44**	.62**	.70**	.81**	-							
7. T1-RC	.70**	.53**	.62**	.60**	.87**	.76**	-						
8. T2-Age	.97**	.47**	.57**	.45**	.65**	.66**	.70**	-					
9. T2-VOCAB	.51**	.44**	.77**	.54**	.64**	.64**	.58**	.58**	-				
10. T2-PA	.41**	.50**	.50**	.77**	.55**	.62**	.47**	.47**	.54**	-			
11. T2- WR	.60**	.49**	.63**	.77**	.93**	.84**	.85**	.63**	.66**	.65**	-		
12. T2-MP	.60**	.45**	.64**	.63**	.75**	.82**	.73**	.61**	.64**	.56**	.77**	-	
13. T2-RC	.66**	.48**	.56**	.73**	.88**	.80**	.84**	.66**	.59**	.63**	.93**	.77**	-

Note. NVR = Nonverbal Reasoning. VOCAB = Vocabulary. PA = Phonological Awareness. WR = Word Reading. MP = Morphological Production. RC = Reading Comprehension. T1 = Time 1. T2 = Time 2. **p < .01.

Table 3.

Hierarchical Linear Regression Analyses Predicting Concurrent Word Reading at Time 1 and Time 2

Time 1				Time 2			
Predictor	ΔR^2	β	t	Predictor	ΔR^2	β	t
1. T1-Age	.45***	.14	1.66	1. T2-Age	.45***	.15	1.67
T1-NVR		.07	.92	T1-NVR		.03	.46
2.T1-VOCAB	.07***	.11	1.30	2.T2-VOCAB	.10**	.14	1.58
3. T1-PA	.10***	.16	1.77	3. T2-PA	.06**	.24	2.78**
4. T1-MP	.08***	.50	4.61***	4. T2-MP	.08***	.42	4.36***

Note. NVR = Nonverbal Reasoning, VOCAB = Vocabulary, PA = Phonological Awareness, MP = Morphological Production, T1 = Time 1, T2 = Time 2. **p < .01, ***p < .001.

Table 4.

Hierarchal Linear Regression Analyses Predicting Word Reading Longitudinally

	Model without Autoregressor			Model with Autoregressor			
Predictor	ΔR^2	β	t	predictor	ΔR^2	β	t
1. T1-Age	.42***	.08	1.09	1.T1-Age	.42***	-.01	-.33
T1- NVR		.04	.73	T1-NVI		.00	.02
2.T1-VOCAB	.08***	.08	1.09	2.T1-VOCAB	.08**	.00	.11
3. T1-PA	.19***	.33	4.14***	3.T1-PA	.19***	.21	4.29***
				4.T1-WR	.20***	.67	10.41***
4. T1-MP	.08***	.48	5.20***	5.T1-MP	.01*	.14	2.21*

Note. NVR = Nonverbal Reasoning, VOCAB = Vocabulary, PA = Phonological Awareness,

MP= Morphological Production, WR = Word Reading, T1 = Time 1. *p < .05, ***p < .001.

Table 5.

Summary of Hierarchical Regression Analyses Predicting concurrent Reading Comprehension

Time 1				Time 2			
Predictor	ΔR^2	β	t	Predictor	ΔR^2	β	t
1. T1-Age	.56***	.21	3.08**	1. T2-Age	.48***	.12	2.17*
T1-NVR		.09	1.60	T1-NVR		.01	.18
2.T1-VOCAB	.04**	.02	.35	2.T2-VOCAB	.04**	-.10	-1.74
3.T1-WR	.20***	.64	6.75***	3.T2-WR	.34***	.80	11.34***
4. T1-MP	.00	.03	.39	4.T2-MP	.01*	.14	2.06*

Note. NVR = Nonverbal Reasoning, VOCAB = Vocabulary, WR = Word Reading, MP = Morphological Production, T1 = Time 1, T2 = Time 2 *p < .05, **p < .01, ***p < .001.

Table 6.

Summary of Hierarchical Regression Analyses Predicting Reading Comprehension Longitudinally

Model without Autoregressor				Model with Autoregressor			
Predictor	ΔR^2	β	t	Predictor	ΔR^2	β	t
1. T1-Age	.49***	.14	2.04*	1.T1-Age	.49***	.09	1.31
T1-NVR		.04	.75	T1-NVI		.02	.40
2.T1-VOCAB	.03*	-.07	-1.07	2.T1-VOCAB	.03*	-.08	-1.16
3.T1-WR	.28***	.65	6.95***	3.T1-WR	.28***	.51	4.32***
				4.T1-RC	.01	.21	1.83
4. T1-MP	.01*	.20	2.12*	5.T1-MP	.01*	.19	2.07*

Note. NVR = nonverbal reasoning, VOCAB = vocabulary, WR = word reading, MP = morphological production, RC = Reading Comprehension, T1 = Time 1. *p < .05, ***p < .001.