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Contributions of phonological processing skills to reading skills in Arabic speaking children

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Abstract This cross-sectional study investigated contributions of phonological awareness (Elision and blending), rapid naming (object, color, letter, and digit), and phonological memory (nonword repetition and Digit Span) to basic decoding and fluency skills in Arabic. Participants were 237 Arabic speaking children from Grades K-3. Dependent measures included word decoding, oral passage reading fluency, nonword reading fluency, and retell fluency. Within-grade analyses indicated that phonological awareness accounted for more variance than rapid naming regardless of the nature of the outcome measure and grade. Rapid naming's capacity to predict variance, while less than that of phonological awareness, tended to rise steadily and was highest in Grade 3. Phonological memory, as measured by this study's tasks, showed almost no relationship to reading performance. The findings are discussed with respect to changing the requirements of Arabic reading in Grades K-3 and suggestions are made for future research.

Keywords Arabic · Phonological processing · Word recognition · Word decoding · Oral reading fluency · Literacy

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Introduction

Across a range of languages and orthographies, concurrent and predictive relationships between phonological processing abilities[1] and performance in basic reading skills (e.g., Gillon, 2004; Goulandris, 2003; Holopainen, Ahonen, & Lyytinen, 2001; Katz & Frost, 1992; Smythe, Everatt, & Salter, 2004; Stahl & Murray, 1994; Suk-Han Ho & Bryant, 1997; Torgesen & Burgess, 1998; Wimmer, Mayringer, & Landerl, 1998, 2000). The current study examines contributions of three fundamental areas of phonological processing—phonological awareness (PA), rapid naming (RAN), and phonological memory (PM)[2]—to early decoding, fluency, and comprehension skills in Arabic.

Although PA, RAN, and PM are important factors in the development of accurate and fluent reading in English, the contribution of these variables to reading in other languages appears to vary depending on the characteristics of the orthography being learned and linguistic context. The vast majority of studies of these factors have been conducted on English (e.g., Muter, Hulme, & Snowling, 1997; Perfetti, 1985; Stahl & Murray, 1994; Torgesen & Burgess, 1998; Torgesen, Wagner, & Rashotte, 1994; Wagner & Torgesen, 1987; Wagner, Torgesen, Laughon, Simmons, & Rashotte, 1993; Wagner, Torgesen, & Rashotte, 1994), despite the fact that English may be characterized as an outlier orthography, which employs perhaps the least regular grapheme-to-phoneme correspondence code of any of the world's languages (see Share, 2008 for an in-depth discussion). The irregular spellings and complex spelling rules of English stem in part from the historical amalgamation of Anglo-Saxon (right, lik, kno), Latin (nat, palm, corpor), Greek (phono-, bio-, -logy) roots, as well as English's more recent borrowings (banjo, tycoon, troika, beau) and inventions (byte, boondoggle, motel; Merriam-Webster, 2003). As such, English is an extremely deep or opaque orthography, requiring the beginning reader to acquire flexible application of myriad options for sound-symbol correspondence. In comparison with shallower, more transparent European orthographies such as Spanish and Italian, the opacity of English complicates as well as significantly prolongs beginning readers' acquisition of accuracy and automaticity for sound-symbol mapping skills (Aro & Wimmer, 2003; Seymour, Aro, & Erskine, 2003). Ziegler and Goswami (2005) have in turn suggested that the irregularities of English challenge the beginning reader's abilities to form stable phonological representations for orthographic patterns. It is, therefore, not surprising that in English the most important predictor for word-level reading accuracy and automaticity is PA.

[1] Phonological processing will be used to refer to the uses of internal forms of speech information for representing, storing and/or retrieving spoken and written language.

[2] Phonological awareness will refer to a set of linguistic and metalinguistic skills involving the capacity to reflect on the sound structure of spoken words (Muter et al., 1997; Stahl & Murray, 1994). Rapid naming (RAN) will reference the capacity to retrieve phonological codes stored in long-term memory (measured by the amount of time required to name a group of stimuli such as numbers, letters, colors, or common objects; e.g., Allor, 2002; Wolf, 1986, 1991). Phonological memory (PM) refers to a processing resource of limited capacity involved in the preservation of information, which in the case of phonological working memory also involves manipulation of the same or other information (Baddeley & Logie, 1999; Swanson & Sáez, 2003).

While PA is critical for predicting the earliest phase of sound-symbol accuracy in English as well as other orthographies, its predictive power quickly diminishes in transparent orthographies such as German, Greek, or Finnish (Holopainen et al., 2001; Seymour et al., 2003; Wimmer et al., 1998, 2000). For example, Wimmer et al. (1998) found that by second grade, German-speaking second graders with reading disabilities exhibit high reading accuracy for pseudowords but very slow reading speed and poor spelling. Similarly, awareness of onsets and rimes does not appear to be particularly relevant for learning to read in Spanish because of its high degree of transparency (Jimenez, Alvarez, Estevez, & Hernandez-Valle, 2000; see Haynes, Ayre, Haynes, & Mahfoudhi, 2009 for a review). In children learning the shallow orthographies of German or Spanish, RAN tasks emerge early as the strongest predictor of reading differences. While RAN performance also predicts automaticity and text level fluency in English-speaking children, this effect is most prominent in Grades 3 and 4 and lags behind that of PA (see Wolf, 1991 for a review). Studies of reading acquisition in other European languages have shown similar findings; the relative contributions of PA and RAN differ depending on the orthographic transparency of the language. RAN is a better identifier of reading accuracy deficits than PA when there is a more direct relationship between letters of an alphabet and their sounds (see Goswami, 2000).

A number of researchers have examined the role(s) of PM in learning to read; however, cross-linguistics comparisons in transparent versus opaque orthographies are sparse. In English, preschool measures of PM (digit span and nonword repetition) have been found to predict basic decoding skills in 8 year-olds, but this association is weak relative to PM's prediction of word learning as well as listening comprehension (Gathercole & Baddeley, 1993; Gathercole et al., 1994). As a whole, reviews of studies of English have replicated this finding of modest associations between PM and decoding accuracy compared to strong associations between PM and comprehension-related factors such as vocabulary learning, sentence processing, and listening comprehension (for reviews, see Brady, 1991; Savage, Lavers, & Pillay, 2007). While less research is available in transparent European orthographies, analogous relationships between PM and reading appear to obtain. For example, in a longitudinal study of Finnish, a highly transparent orthography, preschool PM modestly predicted word recognition in Grades 1 and 2, and was strongly related to listening comprehension (Dufva, Niemi, & Voeten, 2001). In a study of word recognition in German speaking second graders, deficits in PM differentiated poor readers from good readers (Steinbrink & Klatte, 2008). In all of the studies, PM was a weaker predictor of early word recognition than was PA.

In light of the patterns observed for regular and irregular European orthographies, what role do phonological predictors play in Semitic languages such as Hebrew and Arabic, which are considered "abjads," or consonantal orthographies (Daniels & Bright, 1996)? While categorized as abjads, both Hebrew and Arabic are alphabetic and extremely transparent in the introductory phase of instruction in kindergarten or Grade 1. In Arabic and Hebrew texts, letters are used to represent consonants, and vowels are denoted with diacritics markings (dots or lines) placed above or below the consonants.[3] Words are derived from two- or three-consonant root morphemes, and vowels and affixes are added to these roots to create variations of meaning and denote parts of speech (Azzam, 1993; Greenberg, 1965). Thus, inclusion of vowel diacritics, or "vowelization," provides the beginning reader with additional phonological information that helps them to detect the intended meaning and correct pronunciation of words. In Arabic, beginning reader's application of PA to sound-symbol reading skills is complicated by the ubiquitous phenomenon of diglossia, a mismatch between the spoken oral dialect and written or literary Arabic, also termed Modern Standard Arabic (MSA); Saiegh-Haddad (2005) found that young Arabic learners performed less well on a measure of PA based on vernacular Arabic than on a measure base on MSA.

Around the middle or end of Grade 3, when basic decoding skills have been mastered by most typically developing children, vowel diacritics are dropped from the majority of texts.[4] At this juncture, the orthographies transition from being shallow and transparent to being deep and opaque (Abu-Rabia, 2000; Abu-Rabia & Siegel, 2002, 2003; Share, 2008). In contrast with writing that is vowelized, non-vowelized text contains many homographs whose meaning and pronunciation can only be accessed through an appreciation of the surrounding syntactic and discourse context; and its letter-sound relationship information is less available and less salient. For example, if English were an abjad, the non-vowelized homograph *bt* could represent many meanings depending on its context (e.g. *bat*, *bet*, *bite*, *bait*) and could serve as a noun or verb.

Given the orthographic shift from transparency to opacity that occurs in Hebrew and Arabic, questions arise as to the roles that PA, RAN and PM may play in predicting reading development in the phases before as well as after vowel diacritics are dropped. With respect to the role of PA in early reading, studies in Hebrew indicate significant relationships between PA and early word recognition accuracy; however, these correlations are generally lower than observed in English (Geva, Wade-Woolley, & Shany, 1993; Share & Levin, 1999). The findings for Arabic contrast somewhat with those for Hebrew. In a cross sectional study, Al-Mannai and Everatt (2005) found that measures of PA predict real word reading and spelling amongst young Arabic learners. In a study of bilingual Arabic/English speaking third graders, Saiegh-Haddad and Geva (2008) found that beyond oral language proficiency, PA was the only factor explaining unique variance in word reading accuracy in vowelized Arabic, whereas both PA and morphological awareness explained unique variance in English word reading accuracy. They found similar results for reading of phonetically regular nonwords; while the only predictor of pseudoword reading was PA, it was stronger in Arabic than in English. In a study of fifth grade struggling readers of Arabic, Abu-Rabia, Share, and Mansour (2003) found severe PA deficits were associated with deficits in accuracy of decoding vowelized Arabic.

Studies are sparse that have examined predictors of early reading fluency in Arabic. In a study of typically first graders, Saiegh-Haddad (2005) examined the

[3] In Arabic, three long vowels are also denoted as letters and short vowels are noted with diacritics.

[4] A noteworthy exception is that Arabic Qu'ranic texts retain diacritics in order to standardize pronunciation.

contributions of PA, RAN, and PM to letter recoding speed and decoding fluency for pseudowords and found that PA only indirectly predicted fluency through its influence on letter recoding speed, the strongest predictor of decoding fluency. When the influence of letter recoding speed was controlled for, PM was the strongest predictor of reading fluency followed by RAN.

With respect to predictors of reading in Grades 3 and beyond, studies point towards a decreasing power of PA to predict reading skills, increased requirements for sentence processing requirements as well as greater demands on orthographic and morphological processing (e.g., Abu-Rabia, 2007). Remarkably few studies have examined predictors of reading in non-vowelized texts and most are in Hebrew. Bentin, Deutsch and Lieberman (1990) examined factors contributing to fourth grade readers' decoding of non-pointed (non-vowelized) text in Hebrew and observed that poor readers' decoding accuracy was intact, while children showed deficits in analyzing syntactic context. Cohen-Mimran (2009) examined predictors of fifth grade reading of vowelized versus non-vowelized Hebrew texts and arrived at similar results; syntactic measures contributed to reading fluency in the non-vowelized condition. Given strong associations between PM and oral sentence processing (e.g., Montgomery & Evans, 2009), one might predict that PM is likely to play an increasingly important role in the transition to reading non-vowelized texts in Arabic.

In contrast with Saiegh-Haddad and Geva's (2008) finding that morphological abilities played a negligible role in Arabic word recognition of third grade bilinguals, Abu-Rabia (2007) compared typically developing and dyslexic groups at Grades 3, 6, 9, and 12 and found that, within groups and at all grade levels, performance on an orthographic morphology task was a robust, and often sole predictor of word recognition accuracy and reading comprehension in vowelized texts.

Research on reading disabilities in Arabic is limited; as noted above, available findings suggest that phonological processing plays at least a partial role in literacy acquisition in Arabic; however, contrasting findings indicate that these phonological abilities may not explain the same degree of variation in word reading and word decoding as they do in English (see Elbeheri, Everatt, Reid, & Al-Mannai, 2006; Smythe, Everatt, Menaye, Capellini, Cyarmathy, & Siegel, 2008). In addition, predictors of Arabic literacy may vary across grades, particularly as children's experience of non-vowelized text increases (Everatt & Elbeheri, 2008). Hence, differing relationships between reading skills and phonological processing skills in Arabic appear to be based on the stage of reading skill acquisition and changes in orthography.

The relative contributions of PA, RAN, and PM to reading in Arabic remain under-explored. The present study examined the basic phonological processing skills—PA, RAN, and PM—and their capacities to predict word reading, word decoding fluency, text reading fluency, and comprehension fluency in Arabic. Because it was expected that the relationships would differ based on age and changes in the orthography, these relationships were examined in children from kindergarten to third grade. Based on the findings in other languages and the limited studies available in Arabic, the following two broad questions were addressed:

1. Within Grades (KG, 1, 2, and 3), will PA, RAN, and PM performance correlate with basic reading skills and how will these patterns vary?

2. Will the powers of PA, RAN, and PM to predict reading abilities vary as a function of grade?

Method

Participants

Participants included 237 children from kindergarten through Grade 3 whose native language is Arabic (see Table 1). The data were collected from four different schools representing the four demographic areas in Jeddah: North, Middle, Southeast, and Southwest. Arabic language instruction started in kindergarten and placed heavy emphasis on phonics and vocabulary instruction. Across the four schools, curricular goals and objectives, materials, and reading instruction methods were similar. All classes were taught in Arabic. Children from each grade were chosen randomly and consent forms were sent to parents seeking their agreement of participation; parents who agreed to let their children participate in the study were requested to complete a short questionnaire about the academic and language exposure of their child. One question concerned whether the child had received special education services in previous years. If the child had received special education services in previous years, he or she was not included in the study itself. Questions regarding patterns of language use at home were employed in order to control for children's language exposure; specifically, parents were asked about the language used in daily conversation at home, the number of Arabic literacy materials (e.g., books, magazines, and newspapers) present, and how much time the child spent watching Arabic TV or video programs.

Of the 400 of the chosen students enrolled across all schools, 237 were included in the study, based on parental consent, not having received special education services, and parents' completion of the background questionnaire. Table 1 presents demographic characteristics of all participants. The children ranged in age from 6.33 to 9.18 years ($M = 7.35$, SD = 1.14) and came from Arabic ethnic backgrounds and from families in which both parents spoke Arabic at home. Although none had medical problems that interfered with learning, six had corrected vision problems.

Table 1 Demographic and linguistic characteristics of the participants

Grade	*n* of children randomly selected in each grade	*n* of children who returned consent forms	*n* of children with consent forms and parent questionnaire	Mean age	SD
K	100	90	58	6.33	.49
1	100	64	57	7.17	.51
2	100	43	36	8.09	.38
3	100	40	36	9.18	.44
Male	200	99	75		
Female	200	138	112		
Total	400	237	187	7.35	1.14

Measures and procedures

Tests were developed in the areas of literacy (word recognition, word decoding, reading comprehension, and fluency) and phonology (PA, PA, and PM). All measures used were adapted to Arabic using a forward-translation design (Hambleton, 2002), which focuses on both the source- and target-language versions of the test. Because the stimuli in the adapted versions of the assessment instruments depended on specific criteria and features of the Arabic language, forward-translation design helped to establish content, criterion, and conceptual equivalences to the original English versions.

Modern Standard Arabic (MSA), the language of most books and instruction, was used in all measures. There are numerous spoken dialects in the Arabic language that vary from MSA. Because all Arabic children learn MSA, each measure was adapted so that the study sample could include children from different Arabic nations with dissimilar dialects, such as the children found in Jeddah's schools. The final drafts of the adapted versions of all the literacy and phonological measures were pilot tested to establish their reliability and validity. The population used for piloting was a group of 32 children (8 students per grade) whose characteristics were similar to those of the study sample. Based on the collected data, these children were excluded from the original sample and the measures were modified.

The children were tested by specialists whose training included direct instruction followed by 2 weeks of monitored implementation. All tests were administered individually in a quiet room at each school. Each child had one to two sessions (no more than 35 min per session), in which kindergartners and first graders had two sessions to avoid boredom and tiring. The sequencing of the tests was counterbalanced so as to avoid order effects.

Cognitive abilities

The Arabic version of Test of Non-Verbal Intelligence was administered to assess individual differences in cognitive ability among the participants. This test was adopted in Kuwait to Arabic based on TONI 2. The test uses a language-free format and contains two parallel formats (a and b) each one consists 55 test items and six trial items. For each item, participants are presented with an incomplete matrix and are asked to select a geometric shape that will correctly complete the matrix. This test was selected because of its ease of administration, short administration time (15–20 min), and high internal consistency reliability (.70) reported in the manual. Based on the performance data from the current study, internal consistency reliability was .85 (Mursi, 1999).

Word recognition

This measure was developed for Arabic emulating the same scoring and scoring procedures as are employed for the Letter-Word Identification subtest of the Woodcock-Johnson-III Tests of Achievement (WJ-III; Woodcock, McGrew, & Mather, 2001). Items were developed based on the frequency of letters and words in the Arabic curriculum. Also included were the word-middle form of Arabic letters, which differ slightly from the word-initial shape of letters (e.g., هـ: word-initial shape; ـهـ: word-middle form). The list of words included nouns and verbs; however, the difficulty of words increased with word length, diminishing frequency, and reduction of the number of short vowels (devowelization). This gradual reduction of short vowels represents an incremental transition from words with a shallow orthography to words represented with a deep orthography. Non-vowelized Arabic words can be read differently (diverse meanings), but correctly. Because the WR test presented words in isolation, the non-vowelized words included only words that had exactly the same pronunciation and meaning in their vowelized or non-vowelized forms. The test initially included 97 items. Cronbach's alpha was employed to allow identification and deletion of items of superfluous difficulty or that had low or negative correlations with overall performance. The Cronbach alpha was .96 for the remaining 76 items in the final version of the WR test.

Word decoding fluency

A nonword reading fluency test was designed for this study. It contains 50 vowelized nonwords that are two to three syllables long. Nonwords must be read through a phonological procedure since they do not have a representation in the mental lexicon and they differ from other kinds of pseudowords; although they do not follow the typical phonotactic rules of word building in Arabic, they can still be read. The child was given three practice items and then instructed to read these nonwords as quickly as possible. The nonword stimuli were presented on one sheet in ten rows with five items in each row. After 1 min, the tester stopped the child and the final score was based on the number of correct nonwords read per minute. The Cronbach's alpha for the 50 items included in the test was .97.

Text reading fluency

An oral reading fluency test was designed especially for this study. It contains 12 different narrative texts representing graded levels of difficulty, starting from easy short texts comprised of the most frequent words and containing simple sentence structures, and progressing to texts employing less frequently used words with longer and more complex sentence structures. All words were vowelized because this was a fluency measure and having all words vowelized would control for other aspects of word recognition such as, in the case of devowelization, contextual cues that would help identify words. Each text was presented on a separate sheet and the child was required to read as much as he or she could from all texts starting from the easiest text. The final score was based on the number of correct words read in 3 min. Given the focus on fluency, this test was only given to children from Grades 1 to 3. The Cronbach alpha for each paragraph ranged from .95 to .98.

Comprehension fluency

A retell fluency test was designed to measure students' ability read a text and then retell it accurately and promptly using their own words. This test was given to children from Grades 1 to 3. The same texts for the previous test (text reading fluency test) were used. After the child finished reading the text, he or she was asked to retell what just read as accurately as possible. The tester stopped the child after 1 min. All responses were recorded to evaluate the relativity of the retelling to the text and the number of words. Only words that were related to the text were included; if the child used synonyms or changed the structure of the sentence/s but the word still related to the text, the response was considered correct. If the child stumbled or mentioned something different form the text content, he was instructed by the tester to move to the next text. The final score was based on the number of words that the child said in 1 min for each text. The Cronbach alpha was .89.

The following subtests used in this study were adapted from the Comprehensive Test of Phonological Processing (CTOPP; Wagner, Torgesen, & Rashotte, 1999).

Phonological awareness

Two subtests were developed to measure PA skills, the Elision and blending words subtests (see "Appendix" for subtest sample). The Elision subtest contained a list of 20 items of increasing difficulty. The initial items were compound words which could be segmented by dropping out a whole word (e.g., عبدالله). The segmentation became more difficult as participants were required to drop out increasingly smaller segments of greater phonological complexity. Items progressed in difficulty from deleting syllables, to onset and rime units, to individual phonemes within rime units, and finally to individual phonemes within consonant clusters. After segmentation, each item remained a real word. For the practice items, we added two more trials so that children could comprehend the instructions and task requirements. The initial number of items for the Elision subtest was 23 and this total was reduced to 20 after reliability analyses. The Cronbach alpha was .94. Test–retest reliability was checked after 3 weeks using a randomly selected group of 20 participants in Grades 1–3. The correlation coefficient between scores for the two administrations was .93, $p < .001$.

The items in the blending words subtest were also ordered by level of difficulty, according to word frequency, and following the same scheme employed for Elision, progressing from syllables to phonemes (see "Appendix" for subtest sample). The correct answers represented real words in order to make scoring easier and to make the task more comprehensible for young children. The initial version of this subtest contained 26 items; after reliability testing, the number was reduced to 20 items. The practice items consisted of five practice words to ensure that children comprehended the required task. Cronbach's alpha for the 20 test items was .93. Test–retest reliability was .74, $p < .001$.

Rapid naming

Four RAN subtests, which measure speed of phonological access to lexical information, were used with different ages. Two RAN tasks, rapid color naming and rapid object naming, were employed for ages 5–6, kindergarteners, while rapid digit naming and rapid letter naming were employed for older students in Grades 1–3. Rapid digit naming items were comprised of Arabic numerals and rapid letter naming items were comprised of letters in their stand-alone shapes; the numerals and letters were of high frequency. For all the RAN tests, participants were instructed to name all items on two pages; each page had an array of four rows and nine columns of six randomly arranged colors, objects, letters, or digits. First, each child was shown the individual items on a separate sheet and asked to name them to ensure they knew them. Then, the child was asked to name the test items as rapidly as possible, starting from the top row at the right in order to emulate the right-to-left scanning employed for reading Arabic texts. The combined response time for naming the arrays on both pages was the participant's score. All items that were chosen in all RAN tests have the same level of frequency as in the English version. Based on the data from the present study, the internal consistency reliabilities of, rapid color naming, rapid object naming, rapid letter naming, and rapid digit naming were .88, .83, .97, and .98 respectively and test–retest reliabilities for rapid letter naming and rapid digit naming were .76 and .94, $p < .001$.

Phonological memory

The two subtests employed to test PM were a memory for digits and a nonword repetition task. Both subtests were designed to assess short-term memory. The memory for digits subtest contained 21 series of numbers that ranged in length from two to eight digits. The nonword repetition subtest included 18 nonwords that ranged in length from 3 to 15 phonemes**.** For both subtests, the participant was asked to listen to the items presented on an audiocassette. Then the participant was asked to repeat the numbers in the same order in which they had been presented or to correctly repeat the nonwords; a correct response received a score of 1. Based on the data from the present study's whole sample, the internal consistency reliabilities of the memory for digits subtest and the nonword repetition subtest were .88 and .97, respectively; test–retest reliability for the memory for digits subtest was .71, $p < .001$ and for the nonword repetition subtest was .51, $p < .05$.

Results

The purpose of this investigation was to examine relationships—correlational and predictive—between phonological processing abilities (PA, RAN, and PM) and early reading development (WR, NRF, ORF, and RF) within grades.

Descriptive statistics

Table 2 displays descriptive statistics for children's scores on phonological and reading tasks in kindergarten through Grade 3. One-way analyses of variance (ANOVA) were run to evaluate mean differences for grade. Welch statistics—robust tests of equality of means—were used instead of standard F statistics due to unequal sized groups. Significant between grade differences were observed in all tasks except for nonword repetition. These differences indicate that the measures

Table 2 Means and standard deviations of various tasks by grade and analysis of variance as function of grade

Measures	KG (n = 90)		G 1 (n = 64)		G 2 (n = 43)		G 3 (n = 40)		ANOVA	
	M	SD	*M*	SD	*M*	SD	*M*	SD	*df*	*F*
WR (max 76)	23.0	10.5	41.4	18.2	54.5	19.8	66.7	16.5	3	84.86**
NRF (max 50)	5.3	6.2	14.9	12.8	22.4	13.5	29.5	13.3	3	52.61**
ORF (word/3 min)			12.8	12.0	24.2	22.1	49.7	28.0	2	40.34**
RF (word/1 min)			4.7	6.7	8.9	9.5	13.1	7.5	2	14.59**
EL (max 20)	4.1	4.3	6.9	6.8	9.6	7.3	14.5	6.3	3	29.62**
BW (max 20)	7.6	5.2	9.5	6.2	10.2	7.0	13.5	7.6	3	8.43**
RANC (ms)	98.0	29.8							2	13.66**
RANO (ms)	112.4	28.3							2	13.78**
RANL (ms)			77.0	40.1	54.6	24.8	46.7	15.8	3	82.54**
RAND (ms)			79.6	53.9	52.5	21.5	41.8	13.3	3	13.06 (p = .42)
MD (21)	7.4	1.9	8.5	2.6	9.7	4.0	10.0	1.9	3	84.86**
NR (18)	7.1	3.6	6.6	3.8	7.8	4.0	7.5	3.6	3	52.61**
TONI	8.1	4.0	8.0	3.9	9.7	4.3	11.6	4.0		

** $p < .001$

WR word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency, *EL* Elision, *BW* blending words, *RANC* rapid color naming, *RANO* rapid object naming, *RANL* rapid letter naming, *RAND* rapid digit naming, *MD* memory for digits, *NR* nonword repetition

Table 3 Analysis of covariance for the outcome measures

Outcome measure	Cognitive ability F (*df*)	Gender F (*df*)	Language exposure F (*df*)
WR	17.1*** (1, 186)	5.1* (1, 186)	3.3 (1, 186)
NRF	23.6*** (1, 186)	5.1* (1, 186)	7.1** (1, 186)
ORF	21.5*** (1, 128)		6.5* (1, 128)
RF	23.6*** (1, 128)		7.2** (1, 128)

*** $p < .001$; ** $p < .01$; * $p < .05$

WR word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency

employed, with the exception of NR, are sensitive to developmental differences between grades.

Analyses of covariance (ANCOVA) were conducted to determine whether gender, Arabic language exposure, or nonverbal cognitive ability were covariates of any of the outcome measures (see Table 3). The ANCOVA results indicate that nonverbal cognitive ability, gender, and language exposure had significant effects on different outcome measures; therefore, all these variables were accounted for in the regression analyses as a composite control variable.

Within-grade analyses of phonological predictors of reading outcomes

Correlations among measures were calculated for each grade (Tables 4, 5). The criterion for significance was set at $p \leq .005$ using a Bonferroni correction in order

Table 4 Correlations among outcome and predictor variables for kindergartners and first graders

KG/G 1	WR	NRF	ORF	RF	EL	BW	RANC	RANO	RANL	RAND	MD	NR
WR	–	.74**	.	.	.69**	.68**	−.44**	−.34**	.	.	.28*	.27*
NRF	.88**	–	.	.	.64**	.65**	−.38**	−.39**	.	.	.40**	.27*
ORF	.90**	.85**	–	.	.	.	.	.	.	.	–	–
RF	.60**	.60**	.69**	–	.	.	.	.	.	.	–	–
EL	.80**	.74**	.80**	.61**	–	.60**	−.18	−.21*	.	.	.35**	.24*
BW	.62**	.57**	.65**	.48**	.59**	–	−.23*	−20*	.	.	.32*	.33**
RANC	.	.	.	.	.	.	–	.65**	.	.	−.23*	−.22*
RANO	.	.	.	.	.	.	.	–	.	.	−.33*	−.11
RANL	−.62**	−.56**	−.53**	−.35*	−.47**	−.43**	.	.	–	.	.	.
RAND	−.50**	−.48**	−.42**	−.27*	−.39*	−.37*	.	.	.82**	–	.	.
MD	.45**	.39*	.37*	.22	.28*	.17	.	.	−.37*	−.32*	–	.29*
NR	.38*	.37*	.43**	.52**	.40*	.50**	.	.	.20	−.36*	.25*	–

** $p < .001$; * $p < .05$

"." not administered, *WR* word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency, *EL* Elision, *BW* blending words, *RANC* rapid color naming, *RANO* rapid object naming, *RANL* rapid letter naming, *RAND* rapid digit naming, *MD* memory for digits, *NR* nonword repetition

Table 5 Correlations among outcome and predictor variables for second and third graders

G 2/G 3	WR	NRF	ORF	RF	EL	BW	RANL	RAND	MD	NR
WR	–	.87**	.86**	.72**	.76**	.54**	−.67**	−.58**	.42*	.54**
NRF	.74**	–	.87**	.72**	.74**	.53**	−.65**	−.56**	.31*	.49*
ORF	.72**	.82**	–	.87**	.76**	.51*	−.55**	−.40*	.38*	.50*
RF	.63**	.64**	.77**	–	.61**	.50*	−.45*	−.44*	.28	.60**
EL	.69**	.76**	.73**	.66**	–	.43*	−.54**	−.42*	.44*	.47*
BW	.50*	.45*	.37*	.44*	.35*	–	−.47*	−.44*	.20	.60**
RANL	−.61**	−.60**	−.52*	−.40*	−.50*	−.20	–	.78**	−.45*	−.40*
RAND	−.53**	−.66**	−.53**	−.46*	−.57**	− 23	.70**	–	−.30*	−.45*
MD	.13	.08	.03	.01	.05	.03	−.11	.03	–	.50*
NR	.43*	.50*	.42*	.55**	.38*	.59**	−.20	−.38*	−.02	–

** $p < .001$, * $p < .05$

WR word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency, *EL* Elision, *BW* blending words, *RANC* rapid color naming, *RANO* rapid object naming, *RANL* rapid letter naming, *RAND* rapid digit naming, *MD* memory for digits, *NR* nonword repetition

to control for Type I error. These two tables are divided diagonally to represent correlations for different grade; in each table correlations for the lower of the two grades are displayed in the area above the diagonal.

The correlations among reading outcome variables, as shown in Tables 4 and 5, were high in all grades assessed ($rs = .61$–$.90$). Most of the phonological processing variables correlated significantly with the reading outcome variables, with the variable Elision consistently showing the highest correlations in every grade. Correlations between Elision and word recognition are highest at Grade 1 ($r = .80$) then decrease gradually in later grades. There are, in general, slight increase of correlations between Elision measure and the nonword reading fluency and retell fluency measures starting from early grades; however, the correlations to some extent decrease with oral reading fluency measures. rapid letter naming measures showed peak of correlations with all outcome measures in the second grade, while rapid digit naming measures attained the highest correlations with all outcome measures in third grade.

The PM variables correlate significantly with the outcome measures; however, these correlations are lower in range than for the other predictor variables, with nonword repetition showing greater correlations than memory for digits. Memory for digits did not correlate significantly with any outcome measures on Grade 3 while nonword repetition shows moderate correlations ranging from $rs = .42$–$.55$. Nonword repetition reached its peak correlations with all outcome measures in the second grade data, especially with retell fluency performance ($r = 60$).

While the correlational analyses were used to explore the relationships between individual variables, hierarchical regression analyses were employed in order to examine the best predictors of the several reading outcomes and to compare their contributions within each grade level.

In order to examine the possibility of changing roles of phonological processing in beginning reading as a function of early grade level, within-grade regression analyses were conducted that explored the contributions of PA, RAN, and PM to children's scores on outcome variables at each grade level, from kindergarten through Grade 3. Preparatory analyses were conducted before performing the hierarchical regression analyses. The first step was to examine for multicollinearity in order to identify any predictors that might account for much of the same variance in the outcome variables. Variables with *rs* values of .75–.90 are potentially collinear. The data in Tables 4 and 5 indicated high intercorrelations among RANs predictors (*rs* = .65–.82), which could have caused multicollinearity; other intercorrelations between predictors variables were in the acceptable levels for determining the predictors' independent contributions to variance in reading (Stevens, 2002).

Because it is generally more reliable to use the composite score of sub-tests related to a given construct to measure a specific cognitive skill, a PA composite comprised of the Elision and word blending standard scores was developed, a RAN composite comprised of rapid object naming and rapid color naming for

Table 6 Summary of within-grade hierarchical regression analyses for phonological processing skills predicting outcome measures from KG to third grade entering PA first

Model and variable	KG (n = 90)		G 1 (n = 63)		G 2 (n = 43)		G 3 (n = 40)	
	β	R^2	β	R^2	β	R^2	β	R^2
WR								
Gender, language exposure, and cognitive	.00	.06	.44	.26**	.52	.28**	.22	.05
PA	.80	.53**	.74	.38**	.78	.32**	.71	.46**
RAN	−.29	.05**	−.25	.05*	−.34	.07*	−.35	.10*
PM	−.06	.00	.13	.01	.07	.00	.07	.00
NRF								
Gender, language exposure, and cognitive	.02	.06	.45	.27**	.53	.29**	.13	.11
PA	.62	.46**	.53	.32**	.74	.29**	.67	.41**
RAN	−.25	.06**	−.20	.03*	−.31	.06*	−.46	.16**
PM	.08	.00	.15	.02	−.05	.00	.00	.00
ORF								
Gender, language exposure, and cognitive			.43	.27**	.39	.19*	.40	.16*
PA			.76	.40**	.88	.40**	.58	.31**
RAN			−.12	.01	−.18	.02	−.36	.10*
PM			.12	.01	.04	.00	−.02	.00
RF								
Gender, language exposure, and cognitive			.33	.12*	.41	.19*	.43	.20*
PA			.63	.28**	.68	.24**	.58	.31**
RAN			−.00	00	−.14	.01	−.22	.04
PM			.28	.06*	.22	.03	.18	.02

** $p < .001$; * $p < .05$

WR word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency, *PA* phonological awareness, *RAN* rapid naming, *PM* phonological memory kindergartners and rapid letter naming and rapid digit naming for Grades 1, 2, and 3. PM composite was comprised of the memory for digits and nonword repetition scores. These composites were used in all of the regression analyses.

For the first set of regression analyses, PA was entered second (after controlling for gender, language exposure, and cognitive ability). RAN was entered in the third step, followed by PM in the fourth. The analyses examined the outcome variables. The results in Table 6 reveal that the capacity of PA to predict word recognition and nonword reading fluency measures started strong at kindergarten (53 and 46% of the variances respectively). This capacity decreased in Grades 1 and 2, however, picked up again in Grade 3. After PA is entered, RAN is left to explain small but significant amounts of variances. While RAN explained minimal variances beyond what was explained by PA, the percentages of variance explained increased with age, and RAN's capacity to predict word recognition, nonword reading fluency, and oral reading fluency was most evident in the third graders' performance. The case with oral reading fluency was different; the predictive power of PA was the same in both Grades 1 and 2, but started to diminish by third grade. It seems that RAN was emerging at Grade 3 by explaining 10% of the variance beyond what was explained by PA; it is noteworthy that RAN did not explain any significant variance on Grades 1 and 2. Surprisingly, even though nonword reading fluency is a speeded task and one would speculate that RAN would account for more variance than what PA accounted for, PA predicted higher variances in word recognition, than with nonword reading fluency in all four grades.

For the next set of regression analyses, RAN was entered as the second step (after controlling for gender, language exposure, and cognitive ability) followed by PA (see Table 7). Although, RAN accounted for significant variances, PA still accounted for higher variances beyond what was accounted for by RAN, especially in the early grades, in all outcome measures. When word recognition or nonword reading fluency were the outcome variables, the predictive power of RAN increased by grade and explained more variance than PA by third grade; in kindergarten and first grade, PA accounted for more variances in these word-level outcomes than did by RAN. By second grade, RAN explained higher variances in word recognition and nonword reading fluency, but, interestingly, not in oral reading fluency. RAN showed higher predictive power than PA for word recognition, nonword reading fluency, and oral reading fluency at the third grade level only.

In sum, the correlations between PA and RAN variables were significant but low to moderate in size, which indicated minimal risk of collinearity confounding the models. PA proved to be a significant predictor of unique variance in all of the reading outcomes—recognition, decoding, fluency, or comprehension (Table 6). When children read lists of words, whether real or nonwords, the predictive power of PA was highest in the early grade, decreased at the second, but caught up again by third grade. Reading words within text showed different results; PA predicted higher variances in early grades but this power diminished by third grade, where RAN predicted more variances than previous grades. These results were also supported when RAN was entered before PA; that is, PA still explained significantly high amounts of variance that were not explained by RAN on first and second grades; however, the predictive power of RAN increased by third grade and

Table 7 Summary of within-grade hierarchical regression analyses for phonological processing skills predicting outcome measures from kg to third grade entering ran first

Model and variable	KG ($n = 90$)		G 1 ($n = 63$)		G 2 ($n = 43$)		G 3 ($n = 40$)	
	β	R^2	β	R^2	β	R^2	β	R^2
WR								
Gender, language exposure, and cognitive	.17	.06	.44	.26**	.52	.28**	.22	.05
RAN	−.41	.16**	−.46	.19**	−.55	.24**	−.61	.37**
PA	.70	.43**	.64	.24**	.61	.16*	.53	.20**
PM	−.04	.00	.14	.01	.07	.00	.07	.00
NRF								
Gender, language exposure, and cognitive	.16	.06	.46	.24**	.53	.29**	.32	.11
RAN	−.41	.16**	−.41	.15**	−.51	.20**	−.66	.43**
PA	.65	.37**	.60	.21**	.58	.15**	.44	.14**
PM	.08	.00	.15	.02	−.07	.00	.00	.00
ORF								
Gender, language exposure, and cognitive			.43	.27**	.40	.19*	.40	.16*
RAN			−.36	.11*	−.45	.16*	−.54	.29**
PA			.71	.30**	.79	.27**	.40	.14*
PM			.12	.01	.04	.00	−.02	.00
RF								
Gender, language exposure, and cognitive			.33	.12*	.41	.19*	.43	.20*
RAN			−.22	.04	−.35	.10*	−.44	.19*
PA			.63	.23**	.60	.16*	.47	.16*
PM			.27	.06*	.22	.03	.18	.02

** $p < .001$; * $p < .05$

WR word recognition, *NRF* nonword reading fluency, *ORF* oral reading fluency, *RF* retell fluency, *PA* phonological awareness, *RAN* rapid naming, *PM* phonological memory

exceeded PA's predictive power (Table 7). PM's capacity to predict unique variance was confined to retell fluency ($R^2 = .06$), a measure of comprehension, in Grade 1.

Discussion

This cross-sectional study examined relationships between phonological processing abilities and basic reading skills in Arabic-speaking children in Grades K to 3. The first question examined the general relationships between the three components of phonological processing (PA, RAN, and PM) and selected reading skills (word recognition, nonword reading fluency, oral reading fluency, and comprehension as measured through retell fluency). The results revealed that, within each grade, phonological processing abilities correlated significantly with all reading skills and that these relationships ranged from moderate to high, with PA skills showing higher correlations with reading than RAN or PM. These finding are consistent with other studies of Arabic (e.g., Al Mannai & Everatt, 2005; Elbeheri & Everatt, 2007; Saiegh-Haddad & Geva, 2008) and generally mirror the results of two decades of English studies (e.g., Perfetti, 1985; Wagner et al., 1993, 1994; Torgesen et al., 1997).

Given the unique characteristics and changing requirements of Arabic orthography, the relationships of each of the three components of phonological processing were expected to differ based on the characteristics of the reading skills. It was speculated that the intercorrelations between reading fluency measures (i.e., nonword reading fluency and oral reading fluency) and RAN would be higher than with PA measures due to Arabic's shallow orthography in Grades K-2 and the general retrieval speed requirements of these reading tasks. However, it seems that the demands of reading Arabic as well as the readers' lack of automaticity required participants in these earliest grades to rely on PA and dependent on grapheme-to-phoneme conversion processes much more than on speeded gestalt processes thought to be tapped by RAN.

The PA measures in the current study employed stimuli of gradually decreasing grain size, from word, to syllable, to phoneme level. Follow-up analyses revealed that on elision and blending tasks, kindergarten and first grade participants showed mastery only to the level of the syllable—grain sizes that are consistent with the period of reading prior to when phonic reading of shallow, vowelized Arabic text is introduced. These data from Arabic support previous findings from English that the awareness of larger phonological units, not just phoneme-level awareness, is linked with early reading development (Anthony & Lonigan, 2004; Wagner et al., 1993, 1994).

Ziegler and Goswami (2005) have suggested that reading and PA skills develop interactively. That is, vocabulary growth and repeated exposure to the statistical regularities present in spoken language may provide the basis for learning about the phonological properties of language, but the access to individual phonemes does not develop prior to formal, alphabetic reading instruction. Their argument is that through exposure to orthographic patterns and their corresponding sounds, children develop the ability to isolate phonemes in the speech stream and understand that letters or letter combinations represent phonemic elements of speech. This study's examination of consistent between-grades differences on the PA measures supports this view that PA and reading skills develop hand-in-hand. Furthermore, the analyses suggest that this study's PA subtests are developmentally sensitive measures for the grades assessed and that within grades, the PA composite is an effective predictor of basic reading skills.

This study's second question was related to the between-grades differences in phonological predictors of reading performance. The dominant predictor of all reading outcome measures in each grade was PA after the influence of the control variables was accounted for. Even when RAN was entered into equations first, PA explained the largest amounts of variance in the reading outcome measures. These results are in line with the findings of numerous longitudinal and meta-analytic studies of English and other alphabetic orthographies that have confirmed that the single best predictor of future reading achievement is PA (e.g., Catts, Fey, Zhang, &

Tomblin, 2001; Lyytinen, et al., 2004; Scarborough, 1998; Snowling, Gallagher, & Frith, 2003).

Regression analyses of within grade predictors of reading skills provided insights into the changing process and progress of Arabic reading at different early grade levels. The results support the view that PA should best predict reading in the earliest grades, when the orthography is shallow. In the current study's word recognition measure, the first 48 words were vowelized and the more advanced items were non-vowelized. Participants in kindergarten and Grade 1 were most able to read the vowelized items (Grade 1 $M = 41.42$ words) and PA was the only strong predictor of word recognition even after controlling for the influence of RAN. This pattern suggests that children at these early ages achieved word reading accuracy primarily through reliance on the phonological information offered by the individual graphemes on the page (letters and diacritics). In contrast, the mean raw scores for word recognition performance of children in second and third grades were higher (54.47 and 66.7 respectively), so children in those grades had reached a stage where they were identifying non-vowelized words. From Grades K through 2, as children's sound-symbol decoding automaticity increased and they transitioned to reading non-vowelized words, the predictive power of PA generally decreased, while an upward spike of PA in Grade 3 may reflect word recognition's complex phonological coding demands presented when encountering words that are non-vowelized. A generally reversed pattern was obtained for RAN; its predictive power, while remaining lower than that of PA overall, increased in Grades 2 and 3. This increase in the predictive power of RAN appears to correspond with increasing automaticity of decoding in Grade 2 and increased demands on orthographic processing in the non-vowelized word recognition stimuli encountered in Grade 3. Despite the increasing power of RAN to predict word recognition, PA captured the most variance overall in word recognition in each of Grades K-3. An explanation for the persisting role of PA in reading of Arabic real words may lie in part in the requirements of the word recognition task. That is, when more experienced readers are faced with non-vowelized words within text, they rely on context to infer the words' identities; however, because words on the word recognition test were presented as isolated items in a list, third graders may have been forced to rely on incomplete phonological information for recognizing the words. Therefore, the role of PA in word recognition of isolated Arabic words remains important and the orthographic inconsistency of non-vowelized words may actually force readers to rely more heavily than one might expect on phonological information for determining the meaning of words (Ziegler & Goswami, 2005).

Interestingly, the findings from regression models for prediction of within grade nonword reading fluency, while not identical to those for word recognition, showed patterns that are somewhat similar. Regardless of whether PA or RAN were entered first into the models, PA showed a generally strong role in predicting fluency in grade levels with the peak of predictive power in kindergarten and decrease afterwards to progress highly by third grade. While RAN's predictive power was lowest in range in the first grade, it steadily increased and spiked strongly at Grade 3 when basic decoding skills are more automatic. These findings are consistent with the view that fluency in the beginning grade levels relies on accuracy of decoding—

a skill that is highly dependent on PA. In parallel, as children progress to second and third grades and develop decoding that is more automatic, the predictive power of RAN increases.

The findings for oral reading fluency are based on students' speed and accuracy while reading vowelized texts. In contrast with Wimmer and colleagues' argument that RAN is the most powerful predictor of reading fluency in a transparent orthography, this study's within-grades analyses indicate that PA plays a more dominant role than RAN. While PA's predictive power entirely eclipses RAN's in Grades 1 and 2 (*Rs* were not significant as shown in Table 6), RAN increases rapidly in Grade 3. These findings suggest that, at least in the beginning years of school, PA remains critically important for predicting speed in transparent forms of Arabic text.

It appears that children at early age process reading list of real words and nonwords similarly and they rely on phonological information offered by individual graphemes to recognize vowelized and non-vowelized words. These results mirror the findings of previous studies in Arabic (e.g., Al-Mannai & Everatt, 2005; Saiegh-Haddad & Geva, 2008). When the words surrounded with context, the process of reading behave differently; by third grade, the power of PA decreasing and children start relaying on other cognitive sources to process words within text (as suggested by Abu-Rabia, 2007; Bentin et al., 1990; Saiegh-Haddad & Geva, 2008), such as orthographic and morphological processing.

This current study is not without limitations. Confining the subject pool to children from kindergarten through third grade prevented the opportunity to explore the powers of PA, RAN, and PM to predict reading skills of children in Grades 4 and beyond when students are reading non-vowelized texts of increasing morphological and syntactic complexity. While participants in kindergarten and Grade 1 could not have been expected to read non-vowelized connected text, the absence of such a measure limited the opportunity to fully compare the processes of reading in vowelized versus non-vowelized text formats in Grades 2 and 3. In addition, while this study elucidated the contributions of PA and RAN in reading, the PM composite's limited test–retest reliabilities, particularly for nonword repetition, suggests that this study's results may not fully reflect the contribution of PM to children's early reading skills.

Although PA emerged as a robust predictor of reading skills in Arabic in each grade, the fact that this variable predicted heterogeneous outcomes suggests a need to address the complex nature of the PA construct itself. In the current study, Elision (a component of the PA composite) correlated significantly with disparate phonological as well as nonverbal factors including but not limited to both: pictorial and symbolic assessments of RAN (objects, letters, digits), PM, and visual-spatial skills (TONI) (Tables 4, 5). This suggests that, while the current study (and many others) treated PA as a unitary construct, PA tasks like Elision may actually tap a conglomerate of different sub-processes or sub-skills, subsets of which activate in different patterns in response to the overlapping and/or distinctive requirements of sometimes extremely varied reading tasks such as (a) transparent word recognition in kindergarten through second grade, (b) opaque (non-vowelized) word recognition items encountered in Grade 3, as well as (c) decoding automaticity and text level fluency. Future studies examining both the phonological and non-linguistic cognitive requirements of PA tasks will need to elucidate PA's versatile capacities to predict a range of basic Arabic reading tasks.

Lastly, the current study compared cross-sectional data in order to make developmental inferences about changing relationships between phonological predictors and reading outcomes. While the phonological processing sub-tests developed for these analyses, PA and RAN in particular, appear to be developmentally sensitive and informative; a longitudinal study, however, is needed in order to map individual children's actual growth trajectories for various phonological processing and reading abilities. Tracking the same students over time and extending the span of study to the later grade school years will allow researchers to draw more definitive conclusions about the changing relationships between PA, RAN, and PM, and the literacy outcomes they are designed to explain and predict.

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Appendix

Sample of the Elision subtest

الله	'قل عبدالله. الآن قل عبدالله من غير أن تقول عبد "
عبد	'قل عبدالرحمن. الآن قل عبدالرحمن من غير أن تقول الرحمن"
أخ	'قل أخضر. الآن قل أخضر من غير أن تقول ضر"
جاء	'قل أرجاء. الآن قل أرجاء من غير أن تقول أر."
مسلم	قل مسلمون. الأن قل مسلمون من غير أن تقول ون
تين	قل بساتين. الآن قل بساتين من غير أن تقول بسا.
نام	قل ينام. الآن قل ينام من غير أن تقول يَـ.
مال	قل جمال. الآن قل جمال من غير أن تقول جَـ.
جرى	قل جراد. الآن قل جراد من غير أن تقول /د/.
فر	قل فرد. الآن قل فرد من غير أن تقول /د/.
واد	قل واحد. الآن قل واحد من غير أن تقول حـِ
أحد	قل أحمد . الآن قل أحمد من غير أن تقول مَـ
ساق	قل سباق. الآن قل سباق من غير أن تقول /بـ/
ناهد	قل نشاهد. الآن قل نشاهد من غير أن تقول /شـ/.
فاح	قل فلاح. الآن قل فلاح من غير أن تقول /لـ/.
فر	قل فجر. قل فجر من غير أن تقول /جـ/.
يرثون	قل يحرثون. الآن قل يحرثون من غير أن تقول /حـ/

Sample of the blending words subtest

زيتون	زيـ___تون
فستان	فسـ___تان
أرسل	أر___سل
أم	أُ___مْ
طير	طَ___يْرْ
كَتَبْ	كَـ___تَبْ
سور	سـْ___ور
شاة	شـْ___اة
قط	قـ___ط
بيع	بـَ_يـَ_عْ
نور	نـْ_و_ر
قرد	قـ_ِ_ر_د
ألوان	أ_لـ_و_ا_ن
سفينه	سـ_ِ_فـ_يـ_نـه
سياره	سـ_َ_يـ_يـ_ا_ر_ه
حيوانات	حـ_َ_يـ_و_ا_نـ_ا_ت

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