Psicológica (2014), 35, 251-276.

How does speed and accuracy in reading relate to reading comprehension in Arabic?

Aula Khateeb Abu-Leil[1], David L. Share[1,2] and Raphiq Ibrahim[*1,2]

[1] *Learning Disabilities Department, University of Haifa, Israel*

[2] *The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities, University of Haifa, Israel*

The purpose of this study was to investigate the potential contribution of decoding efficiency to the development of reading comprehension among skilled adult native Arabic speakers. In addition, we tried to investigate the influence of Arabic vowels on reading accuracy, reading speed, and therefore to reading comprehension. Seventy-five Arabic native speakers read fully pointed, unpointed and pseudowords lists of Arabic and silent reading comprehension of pointed and unpointed paragraphs were tested. Reading speed and accuracy measures revealed a slowest and less accurate in reading pseudowords, and fastest and most accurate in reading unpointed words with pointed word naming speed and accuracy in between. Subjects who were fast and accurate in reading isolated words were also fast and accurate in reading all varieties of printed words. Pearson correlation procedures indicated that silent reading comprehension of pointed and unpointed Arabic texts was uncorrelated with either oral reading speed or accuracy. Our findings with regard to the cross-linguistic research literature as well as the specific features of Arabic language are discussed.

Reading comprehension is a complex process involving many subcomponent skills and abilities that vary between readers (Snow & Sweet, 2003). These reading ability differences are typically related to two different levels of processing: lower-level word reading accuracy and fluency and higher-level comprehension-related linguistic and cognitive abilities (Pazzaglia, Cornoldi & Tresoldi, 1993), such as working memory, inferencing, integration of information and the use of metacognitive

[*] Address correspondence to: Raphiq Ibrahim. The Edmond J. Safra Brain Research Center for the Study of Learning Disabilities. University of Haifa. Mount Carmel, Haifa. Israel, 31905. Fax: 972-4-8249353. E-mail: raphiq@psy.haifa.ac.il

strategies (Oakhill, Cain & Bryant, 2003). Both levels of skills are essential for successful reading comprehension. There is a broad consensus that inaccurate and/or laborious word reading impairs the deployment of higher level processes (Hoover & Gough, 1990; Perfetti, 1985; Stanovich, 1991). Based on this assumption, the bulk of research on early reading has focused on understanding the acquisition of fast and accurate word decoding as the essential prerequisite for good reading comprehension.

In the English language, at least, many studies have reported a strong association between word recognition skills and reading comprehension (e.g. Fuchs, Hosp & Jenkins, 2001; Perfetti, 1992). Perfetti's (1992) *verbal efficiency* model suggests that slow word recognition interferes with comprehension. In other words, in order to attain proficient comprehension, the readers' attention should be focused on comprehension while the mechanics of word recognition should operate more or less automatically (Ehri, 2005). Therefore it is not surprising that the most salient characteristic of skillful reading is the speed or fluency with which printed words are translated into spoken language (Adams, 1990). The present study operationalizes this characteristic as fast and accurate oral reading of words. However, we should note here that all the above theories and findings may well be valid for the English language, but it may be unwise to generalize this work directly to Semitic languages such as Arabic which differ a great deal from English both linguistically and orthographically (Abu-Rabia & Siegel, 2003; Share, 2008; Shimron, 1999).

Since so little is currently known about the relation between word recognition and reading comprehension in Arabic, we asked whether word recognition (oral word reading) has the same predictive capacity in Arabic as in English orthography, or whether this capacity is affected by Arabic language-specific features. We hypothesized that Arabic word identification is a complex process, which may demand an additional cognitive effort compared to other languages such as Hebrew (Abu-Ahmad, Ibrahim & Share, 2012; Eviatar, Ibrahim & Ganayim, 2004; Ibrahim, Eviatar & Aharon-Peretz, 2002). Therefore, the process of word recognition may be especially demanding, thereby affecting its relation to reading comprehension. Another goal of the present investigation is to examine the effect of vowel diacritics on the word recognition process and reading comprehension in Arabic orthography.

Arabic language and orthography

Arabic is a Semitic language written in a consonantal alphabet (or "abjad") with 29 basic graphemes, and it is read and written from right to

left. The most characteristically Semitic feature of Arabic orthography is its rich morphology (Azzam, 1989) which is based largely on a concatenative "root-and-pattern" (Abd El-Minem, 1987; Azzam, 1989). The roots generally consisting of three or four consonants and give the basic lexical meaning of the word (Ibrahim, 2008), and the pattern (noun-form or verb-form) supply specific grammatical information such as number, tense, person, gender etc.

Arabic has two orthographic versions: a *shallow orthography* in which short vowels can be indicated using diacritical marks, such as dots and dashes appearing below, above or inside the consonantal base of the word (ذَهَبَ الْوَلَدُ إِلى الْحَقْلِ). These diacritics traditionally appear in some types of materials such as dictionaries and children's books. In the *unpointed* (and therefore partly voweled) *orthography*, vowel diacritics are omitted (ذهب الولد إلى الحقل) (Abu-Rabia, 1997; Azzam, 1989; Oren, 2001).

Shallow orthographies have the advantage of ensuring efficient acquisition of the reading and writing process (Frost, 1994). Share (2008) has termed this feature "decipherability". In Semitic orthographies, vowel signs of all kinds provide phonological information and allow a simple process of grapheme-to-phoneme conversion, which potentially facilitates word recognition by specifying the correct pronunciation of the written word (Azzam, 1989; Frost, 1994, 1995; Shimron, 1999). For instance, in Arabic pointed orthography there is an unambiguous grapheme-to-phoneme relation: كَتَبَ "kataba" (wrote) has one reading option, while the unpointed orthography in which the grapheme-phoneme relation is ambiguous; words create identical forms (homographs) which may be read in different ways and have different meanings. For example, the unpointed word (ktb) كتب has a number of reading options: -كُتِبَ "kutiba" (had been written);كَتَبَ "kataba" (wrote) ; "kutub" كُتُبْ (books). It is important to note that the diacritical marks not only convey phonological cues that help disambiguate homographs and provide word meaning (Abu-Rabia, 2001), but also have grammatical functions (Azzam, 1989), helping the reader determine whether the word is a verb كَتَبَ (wrote) or a noun كُتُبْ (books).

In addition, words are highly dense morphemically, owing to their synthetic nature. Inflectional affixes not only provide the tense, number and gender, but also indicate many functional words (*in, on, from the* etc.,) and possessives (*your, his, my*) that are traditionally affixed to both nouns and pronouns. For example the sentence (**استيقظت صباحا**) translates into five words in English "I woke up/ **استيقظت**/ in the morning /**صباحا** /". This affixation creates additional sources of homography and demands morphemic parsing from the reader (Share & Levin, 1999).

In pointed Arabic orthography the grapheme-phoneme association is almost entirely one-to-one (Azzam, 1989), hence translating phonemes to graphemes should not pose any major difficulty. Accordingly, texts with short vowels are typically for beginning readers in order to insure correct pronunciation (Navon & Shimron; 1984); while texts without short vowels are the norm for more advanced readers and are likely to present difficulties for poor and beginning readers largely owing to the homograph problem (Abu-Rabia, 1997; Azzam, 1989). Unpointed Arabic orthography contains a considerable number of homographs which can be read as different lexical items even though all of them derive from the same consonantal root (Azzam, 1989, 1993) In order to successfully read homographs the reader must rely on linguistic and extra-linguistic sources of knowledge such as phonological, syntax and semantic, lexical and contextual information (e.g., Abu-Rabia, Share & Mansour, 2003; Biemiller, 1970; Cziko; 1980; Saiegh-Haddad, 2003).

In addition to all these features mentioned above there are still unique orthographic and linguistic characteristics which may make the task of reading Arabic even more complicated than any other language. In Arabic script, letters can share the same basic grapheme distinguished only by the presence, position and number of dots {e.g., ب\ن\ت\ث} (Azzam, 1993). Farther, Arabic script is cursive, with the letters of a word linked together by ligatures (Beeston, 1968), and the form of a particular letter varies according to its position in a word. Of the 28 letters, 22 have shapes that differ in initial, medial and final forms when they follow non-connecting letters (as respectively seen in the words (1:/فكر /,2:/نفق/ and 3:/ ,وقف/) for the letter /ف/, and when this same letter is non-connected in the word / خاف/ where it keeps its basic form).while the six other letters have initial and final forms (as respectively seen in the words (1:/جر /and /نار/) (Abu-Rabia, 2001; Azzam, 1993; Ibrahim et al., 2002; 2004; Taouk & Coltheart, 2004). Finally, there are seven different vowel diacritics in the Arabic writing system (بَ, بِ, بُ, بْ, بٍ, بٌ, بًا). Usually these are considered as short vowels, but become lengthened by the addition of the long vowels (A, O, E) which are considered part of the set of consonants (ا, و, ي). Thus, recognizing the diverse orthographic rules for these letters in their different locations and identifying the different vowels below and above them is critical for word decoding and may demand considerable cognitive effort than usual by readers (Abu- Rabia, 2001).

Recently, several psycholinguistic studies have reported that the complexity of Arabic orthography slows the word identification process. The evidence also has revealed that the process of reading acquisition in the

Arabic language is slower than it is in Hebrew (Ibrahim & Eviatar, 2001; Eviatar & Ibrahim, 2004, Abdelhadi, Eviatar & Ibrahim 2011). Bentin and Ibrahim (1996) found that the reaction times for recognizing printed Arabic words by high school seniors native Arabic speakers is longer than the reaction times for recognizing Hebrew words by Hebrew speakers. Furthermore, when comparing visual Arabic word recognition to Hebrew word recognition among Arabic speakers, it found that latencies for printed Hebrew stimuli were faster, although it took longer when the same stimuli were presented in the auditory modality (Ibrahim, 2009). Eviatar and Ibrahim (2004) examined the tested the effects of morphological and orthographic differences between English, Hebrew and Arabic. University students who were native speakers of each of the three languages performed a lateralized consonant-vowel-consonant (CVC) identification task. Dependent measure was the exposure duration of the stimuli. The results show that Arabic readers required longer exposure durations of the syllables than Hebrew readers, who in turn, required longer exposure durations than native English readers.

In addition to the orthographic complexities of written Arabic, there are sociolinguistic properties that are unique for the Arabic language. Arabic is considered as a case of "diglossia": a situation in which there exist two distinct forms of the same language (Ferguson, 1959) used for socially distinct functions (Maamouri, 1998). *Ammia* or Spoken Arabic (SA) is the mother tongue (L1) for all the Arabic speakers and learned first and has a local dialect that does not have a written form. Whereas *fuṣḥa* is more commonly referred to as 'Modern Standard Arabic' (MSA) or 'literary Arabic' (LA) is the (L2) language. For reading, writing and formal communication, literary Arabic is used.

Despite the fact that these two languages belong to the same (Semitic) family and share a subgroup of words (Ibrahim & Aharon-Peretz, 2005), they still differ remarkably on phonetic, phonologic, syntactic, morphosyntactic and semantic levels (Abu-Rabia, 2000; Saiegh-Haddad, 2003; 2004). This marked differentiations between LA and the spoken Arabic dialects, creates a significant linguistic distance (Ibrahim, 1983; Ayari, 1996; Maamouri, 1998) between the language of orality and the language of literacy. This literary version is officially studied at school and is acquired through formal schooling (Abu-Rabia, 2002). LA is regarded as a "High" variety that use for writing and for formal speech functions such as religious sermons or news broadcasts. Wither the "Low" colloquial variety, comprises a multitude of local and ethnic vernaculars that are used for everyday conversation domains (Hudson, 2002; Saiegh-Haddad, 2004; 2005). This diglossia implies that Arabic speakers routinely engaging in

code-switching between *ammiyya* (L) and *fusha* (H) in order to fulfill the demands of "functional differentiation" (Haeri, 1996). This "functional differentiation" leads to linguistic distance between the two sets of language forms (Hudson, 1991; Ibrahim, 1983; Maamouri, 1998).

This functional and formal distance between the two varieties of Arabic is widely considered to impede the initial acquisition of reading among native Arabic beginning readers (Ayari, 1996; Maamouri, 1998; Saiegh-Haddad; 2003). The literary version is an alphabetic orthography that is officially studied in schools and is not acquired without formal learning (Abu-Rabia, 2000), so Arabic schoolchildren are taught to read in a literary language, that is not their mother tongue. This has implication for the acquisition of reading in Arabic and may make models describing reading acquisition in other languages less relevant. For example, in the *simple view of reading* skills (Gough & Tunmer, 1986; Hoover & Gough, 1990; Gough, Hoover & Peterson, 1996), reading acquisition is grafted into oral language. Hence, the alphabetic orthographies map the oral language at the level of phoneme, and this segmentation of the spoken words into phonemes should pave the way for the acquisition of word decoding (Shankweiler & Liberman, 1972). Additionally, according to the ''self-teaching'' hypothesis (Share, 1995), only the ability to translate a printed letter string into its spoken form (i.e., phonological recoding) offers a reliable means of independently identifying new letter strings. Unfortunately, this "self- teaching" function is impaired while learning to read Arabic orthography because there are different phonological systems with overlapping, although not identical, phonemic inventories and with different phontactic composition of syllables. Computing between word decoding and oral and aural linguistic comprehension skills account for individual differences in reading achievements in other languages, (Gough, Hoover & Peterson, 1996) including reading comprehension (Adams, 1990; Goswami & Brayant, 1990). In light of this, when children learn to read in their first language (L1), they are already familiar with the phonological structure of their native language, and had also acquired that language in its oral mode. However, this assumption is not valid among Arabic children where their first language is spoken Arabic and they learn to read in LA.

Ayari (1996) has argued that Arabic diglossia impedes the acquisition of reading skill, because most Arabic children are exposed to literary Arabic only in the first grade, almost as a second language. Thus, they have to cope simultaneously with reading in a second language as well as dealing with a complex orthography. Ayari also argued that early exposure to literary Arabic in the pre-school period may enhance their Arabic reading acquisition (see also Feitelson, Kita, & Goldstein, 1986).

In an experimental training study, Abu-Rabia (2000) examined the effect of early exposure to literary Arabic on initial reading acquisition. Subjects were divided into two groups: the experimental group was exposed to literary Arabic throughout the pre-school period, and the control group was only exposed to spoken Arabic. The participants were tested in reading comprehension in the end of grade 1 and again at the end of grade 2. The results showed that children who were exposed to literary Arabic had superior reading comprehension scores than the control group. In addition, Iraqi (1990) tested the effect of daily reading stories in literary Arabic among kindergarten children on their listening comprehension in literary Arabic and on oral language abilities. The experimental group was exposed to daily reading stories in literary Arabic for 15-20 minutes for a period of 5 months; compared to a control group that also was exposed to daily reading stories but in spoken Arabic. The results also indicated that exposure to literary Arabic enhanced listening comprehension and oral abilities compared to the control group.

Additionally, Saiegh–Haddad (2003) examined the phonological distance between the local dialect of northern Palestinian Arabic and MSA. The study examined the effect of two diglossic phonological variables: phonemes and word syllable structure on the acquisition of phonemic awareness and pseudowords decoding in kindergarten and first grade. It was hypothesized that the linguistic differences between spoken Arabic and (MSA) would interfere with the acquisition of basic reading processes in MSA. The results showed that the diglossic variables interfered with the children's performance of both tasks in both grades.

Recent psycholinguistic studies (e.g. Ibrahim et al. 2005) have further revealed that the two forms of Arabic function in the brain as two separate language systems, such that a literate Arabic speaker is essentially a bilingual. Ibrahim and his colleagues (2007) compared reading measures in Arab and Hebrew monolingual, and Hebrew-Russian bilingual first graders. Arabic speakers had higher scores than monolinguals on tests of phonological awareness, yet those abilities did not facilitate text reading performance for Arab native speakers. The researchers concluded that the native Arabic speakers experienced more difficulty in relation to Hebrew monolinguals and bilinguals in language processing, which might be related to the visual complexity of Arabic orthography.

Reading vowel diacritics

As mentioned above, reading Arabic orthography with vowel diacritics might be expected to facilitate early decoding by reducing

phonological ambiguity. Abu-Rabia and Siegel (1995) investigated the effect of vowels among eighth grade poor and skilled readers. They found that vowelization improved the reading accuracy for both skilled and poor readers. Abu-Rabia (1996) also tested the effect of short vowels on the reading accuracy of pointed and unpointed isolated words and paragraphs in Arabic among skilled Arabic readers. The results showed that vowels were a significant facilitator of word recognition in Arabic orthography. Furthermore, Abu-Rabia (1997) observed this finding among both skilled and unskilled readers. From the studies surveyed above, it can be seen that this work relies heavily on reading aloud as a measure of word reading ability. Thus far, the picture is quite consistent regarding the benefits of pointing when reading aloud isolated words, sentences or texts. However, lacking is an investigation of the relevance of oral reading speed and accuracy to reading comprehension, specifically, silent reading comprehension.

Measures of reading: speed, accuracy and comprehension

On the face of it, oral reading is a direct measure of how a reader quickly and accurately translates written language into its oral form (Fuchs, Fuchs, Hosp & Jenkins, 2001). But what is the relevance of this skill for deriving meaning from text? In many theoretical frameworks, oral reading speed and accuracy had been used as an indicator of overall reading competence, including reading comprehension. In their *automaticity model*, for example, LaBerge and Samuels (1974) put forward the view that if word recognition operates automatically, the reader's cognitive and attentional resources are "freed up to comprehension". Similarly, Perfetti's (1985, 1986, 1992, 1995) *verbal efficiency model* is founded on the assumption that a deficit in word decoding efficiency impairs reading comprehension, and makes reading much less efficient. Perfetti used the metaphor of a "bottleneck"; if the bottleneck is filled with decoding processes, then there would not be space available for comprehension processes. In essence, all of these models share the assumption that efficient low-level word recognition frees up capacity for higher level, integrative comprehension processing of text; this is a key point in framing a theoretical argument that fluent oral reading should correlate with an individual's reading comprehension skill.

Traditionally, oral reading accuracy and fluency are assessed by reading aloud a graded list of words (or pseudowords). These lists are typically graded for length and "difficulty", usually starting with short and high-frequency words that become progressively longer and less-frequent

words (Fuchs et al., 2001; Share, 2008). When reading aloud, correct pronunciation depends on exhaustively specified phonological representations, and does not necessarily involve access to meaning (Coltheart, 1978). However, there is a need here to clarify the differences between reading pointed and unpointed lists of words. Based on the Orthographic Depth Hypothesis (Frost, 2005), the phonological structure of the printed word in a shallow orthography can be easily recovered from print by applying a simple process of phonological computation. In contrast, in deep orthographies like unpointed Arabic, readers are encouraged to process printed words by making use of larger units or word morphology via visual-orthographic structure.

Similarly to this perspective, the *orthographic transparency theory* (Saiegh-Haddad & Geva, 2008) maintains that the relevance to reading of orthographic mechanisms as compared to phonological processes is dependent on orthographic transparency. Hence, phonological processes would be used more in reading orthographically shallow pointed Arabic because the mapping of graphemes to phonemes is consistent unlike unpointed Arabic which is considered a deep orthography. In deep orthographies, word decoding necessitates the use of large-unit orthographic units (such as morphemes) for the retrieval of word pronunciation (Aro & Wimmer, 2003; Saiegh-Haddad & Geva, 2008). Consistent with the idea that non-oral reading involves less exhaustive phonological processing than oral reading; oral reading rates are relatively slow and lag behind silent reading rates (Barker, Torgesen & Wagner, 1992; Frost, 1998).

Frost (1998) assumed that the reader needs a well-specified phonological representation for accurate word naming. If readers are having difficulty in decoding words, then their short-term memory may become overloaded and their ability to comprehend sentences could be affected (Shankweiler, 1989). However, if oral word reading and comprehension skills are based on different underlying skills and abilities, then the ability of oral word reading may not predict reading comprehension. Share (2008) claimed that phonology has a reduced role in lexical decision tasks or silent reading compared to oral reading.

Returning to the Arabic orthography, there are a small number of studies that have investigated the relevance of reading speed to reading comprehension. Abu-Rabia (1999) tested not only the effect of vowels in reading accuracy, but also its relevance to reading comprehension among second and sixth grade native Arab children. Both groups read pointed and unpointed Arabic texts and answered multiple-choice comprehension questions. Reading comprehension was better on pointed than unpointed

Arabic texts in both groups. Additionally, Abu-Rabia (2001) examined the effect of short vowels on the reading accuracy of pointed and unpointed isolated words and pointed and unpointed paragraphs, and its relevance to reading comprehension in Arabic and Hebrew, among adult native Arabic speakers for whom Hebrew was their second language. The results indicated that vowels in Arabic and Hebrew improved the reading accuracy of skilled adult native Arabic readers. Similarly, the Arabic reading comprehension results revealed a significant effect for vowels. Reading comprehension with the fully pointed text was significantly higher. That is the additional phonological information conveyed by vowels facilitated understanding Arabic texts even for skilled native Arabic readers.

However, in all these previous investigations mentioned above, none of the oral reading accuracy measures were significantly correlated with silent reading comprehension skills in Arabic or in Hebrew. These results were explained through the morphology of Semitic languages; reading unpointed script requires more visual-orthographic identification of roots of words and less phonological representation (Ben-Dro, Bentin, & Frost, 1995). Similarly, Abu-Rabia (1998) assumed that the alphabetic orthographies also map morphemes. As a result, reading in alphabetic orthography should benefit from awareness of the morphemic structure of the unpointed script. Therefore, the silent reading strategy of the skilled Arabic readers may rely heavily on familiarity with roots of words (Abu-Rabia, 1998, 2001; Badry, 1983).

The present study

In the present investigation, it was hypothesized that the linguistic distance between the spoken and the written forms of Arabic, together with the complexity of Arabic orthography would impair reading speed and accuracy, and in turn reduces reading comprehension ability for Arabic readers. The question was also posed as to whether fully pointed words help or hinder reading– both oral word reading and text comprehension. In regard to reading comprehension, on the basis of prior research, it was predicted that no significant correlation would be found between oral reading accuracy and speed and silent reading comprehension in Arabic.

METHOD

Participants. The sample consisted of 75 8th graders; native Arabic speakers (42 females and 33 males), ages ranging between 13 and 15 (Mean = 14.12, *SD* = 0.488) recruited from a regular school that was randomly

sampled from a list of public junior-high schools in an urban centre in the north of Israel. All participants completed a demographic questionnaire designed to obtain background data regarding age, gender, religion, ethnic origin, parents' education, socioeconomic status and reading habits. None of the participants suffered from neurological, emotional, or learning disorders. These data were obtained by homeroom teachers, school counselors and psychologists. Students diagnosed as suffering from learning disabilities, ADHD, ADD or other neurological disorders, were excluded from the sample. All the children in the study verbally expressed willingness to participate.

Materials and Stimuli. A set of seven measures were constructed to examine the ability to read accurately and rapidly isolated words, and to examine silent reading comprehension ability.

The first set of three tests provided measures of decoding accuracy and reading time for pointed words, unpointed words and pseudowords. In each task, subjects were asked to read as quickly and accurately as possible. Scores for reading rate (or fluency) were based on the number of words or pseudowords read correctly. In addition, total reading time was also recorded for all the three tasks. The second set of tests assessed four reading comprehension texts; a total time of 45 minutes was given in order to read silently each two texts and answered six multiple questions for each text.

Word reading

Fully pointed word naming: A list of 50 words was taken from an 8th grade book *Almokhtar Men Aladab Alarabie* selected from the Arabic literature curriculum of the Israeli Ministry of education. All words chose were built from 3 to 5 letters length (3-6 syllables) and were judged to be moderately frequents by 5 teachers from the schools, and the words were graded in length and frequency. However, these words appeared unpointed in the book, and we asked from the same teachers to provide us the pointed form of them. This pointed form was presented to our subjects.

Unpointed words naming: A list of 50 different words was taken from the same book and had the same conditions.

Pseudowords naming: A list of 50 pointed legal pseudowords was built from real word from the same book by changing one or two letters.

Reading comprehension: Reading comprehension was assessed with four texts (two pointed and two unpointed) taken from the reading comprehension test for Grade 8 (Ministry of Education 2003-2005). Four

certified Arabic 8th Grade teachers confirmed these materials to be grade-appropriate since all these test texts are unpointed, two texts were retained in their original unpointed form, while two other texts were pointed by a native Arabic-speaking doctoral student trained in linguistics. Each of the test texts was similar in length (300 and 350 words) and followed by six multiple-choice questions. The multiple-choice questions were constructed specifically for the present research and they examined various aspects of comprehension including explicit local information, lexical comprehension, main idea and inferential comprehension. All texts were expository and dealt with general topics of which subjects were not expected to have prior knowledge ("The Olympic Games"; "Friendship"; "The Influence of Chemical Substances"; "Fruit as an Ideal Food"). Participants read each text silently, after which they were required to answer the multiple-choice questions that followed. The texts remained in sight and participants were permitted to refer back to the text if they wished.

Measures

Reading speed. Reading speed scores were the total time in seconds that was needed in order to read each of the isolated word lists.

Reading accuracy. Reading accuracy scores were the raw number of correctly decoded words read aloud from each of the isolated word lists. This number was converted to a percentage out of the total number of isolated words in each list.

Reading comprehension. Reading Comprehension scores were simply the raw number of correct answers. This number was converted to a percentage out of the total number of 12 questions for each type of reading comprehension task.

Procedure. For the assessment of word reading, participants were tested individually in a quiet room in school. The three isolated word lists were administered in the following order: pointed words, pseudowords and unpointed words. Total reading time and accuracy rate were measured for each list. After completing the reading tasks, participants were asked to complete the background questionnaire.

The reading comprehension tasks were administered to groups of 15 students over two consecutive sessions. Testing sessions lasted about 45 minutes during which participants silently read two texts and answered six multiple questions for each text. The first session included two texts- the first pointed and the second unpointed. Participants read each of the texts

silently, and then answered the multiple-choice questions. Two days later, in the second test session, the two remaining texts were given with the same instructions and procedure.

RESULTS

The data were initially analyzed with repeated measures analysis, used to test differences between the three reading tasks; reading time, reading accuracy and reading comprehension in pointed and unpointed texts.

For the Arabic speakers, repeated measures analyses were conducted to determine whether reading speed and accuracy differed among the three word types (pseudowords, unpointed and pointed words). Table 1 presents the Means and standard deviations (SD) for reading speed, accuracy and reading comprehension measures

Table 1: Means and standard deviations (SD) for reading speed, accuracy and reading comprehension measures among 8th Graders in Arabic (n = 74).

	Speed (secs. per word)			*Accuracy (percent)*			Reading comprehension *(percent)*	
Task	Pseudowords	Pointed words	Unpointed words	Pseudowords	Pointed words	Unpointed words	Pointed texts	Unpointed texts
M	2.3	1.6	1.10	82.6	88.6	95.9	82.88	70.66
(SD)	(0.75)	(0.62)	(0.4)	(10.3)	(6.7)	(4.22)	(14.43)	(14.52)

A significant overall effect for wordtype was obtained on measures of speed ($F(2, 15) = 305.57$, $p < 0.001$). Follow-up pair-wise comparisons revealed significant differences between pseudowords and fully pointed word naming speed, ($F(1.74) = 209.02$, $p < 0.001$, and between pseudowords and unpointed word naming speed, ($F(1.74) = 413.2$, $p < 0.001$), and between pointed and unpointed word naming ($F(1.74) = 191.45$, $p < 0.001$). These results indicate that the Arabic-speaking students

were slowest in reading pseudowords, and fastest in reading unpointed words, with pointed word naming speed in between.

Reading accuracy for these same three lists revealed a similar pattern. The overall analysis was again found to be significant, $F(2,15) = 115.83$, $p < 0.001$. Significant differences were found between pseudowords and fully pointed word naming accuracy, $F(1.74) = 44.13$, $p < 0.001$; pseudowords and unpointed word naming accuracy, $F(1.74) = 162.8$, $p < 0.001$, and between pointed and unpointed word accuracy, $F(1.74) = 134.44$, $p < 0.001$. These results indicate that the Arabic-speaking students made the highest mean number of errors in reading pseudowords, the smallest mean number of errors in reading unpointed words, with, once again, pointed word errors in between. A paired samples *t*-test was also employed to test the differences between fully pointed and unpointed reading comprehension. A significant difference was obtained, $t(74) = 6.96$, $p < 0.001$, with subjects attaining higher accuracy in comprehending pointed texts (82.9) compared to unpointed texts (70.66). This is in spite of the fact that oral word reading was slower and less accurate for pointed as opposed to unpointed texts.

Correlations within language

Relationships between the various Arabic language measures were analyzed using Pearson correlations. The Pearson correlation matrix among all word reading measures in Arabic appear in Table 2.

The intercorrelations among all the reading conditions for the Arab subjects are presented in Table 2. Strong correlations were found between all the measures of naming speed, ranging from 0.75 for the correlation between unpointed and pseudoword reading time, to 0.86 for the correlation between pointed and unpointed word naming speed. This indicates that subjects who are fast in reading isolated words are also fast reading all varieties of printed words–pointed, unpointed, and pseudowords.

Second, in measures of accuracy, moderate correlations were found between all the reading tasks, ranging from 0.49 and 0.65

Third, the within-task correlations between word reading accuracy and word reading speed were moderate to weak (.42 - .45) indicating that reading most of the variance in accuracy and speed is *not* shared.

Table 2: Pearson correlation matrix among all word reading measures in Arabic.

	Word reading speed			Word reading accuracy		
	Pseudo word	Pointed word	Unpointed word	Pseudo word	Pointed word	Unpointed word
Pseudo word RT						
Pointed word RT	0.84**					
Unpointed word R	0.75**	0.86**				
Pseudo word accuracy	0.44**	0.32**	0.38**			
Pointed word accuracy	0.39**	0.42**	0.52**	0.65**		
Unpointed word accuracy	0.32**	0.35**	0.45**	0.49**	0.58**	1

RT: Reading time in seconds.

*$p < 0.05$, ** $p < 0.01$, *n.s* = not significant.

Reading comprehension as a function of decoding speed and accuracy

Pearson correlations between word reading (speed and accuracy) for all three word reading tasks with reading comprehension (pointed and unpointed) among native Arabic readers are presented in Table 3.

For the Arabic subjects, the correlation between pointed texts and unpointed texts was significant but not strong (r = 0.45). The most important and interesting finding was that silent reading comprehension of pointed text was uncorrelated with either oral word reading speed or accuracy. In the case of unpointed reading comprehension the correlations were either non-significant or extremely weak. Surprisingly, even the correlations for unpointed word reading time and accuracy were extremely low (less than .30). The present data indicate that silent reading comprehension is largely unrelated to oral word reading accuracy and speed in Arabic.

DISCUSSION

We examined the relationships between oral word (pointed and unpointed) and pseudoword reading and (silent) reading comprehension in

L1 Arabic. Significant positive correlations were found between all three reading measures of (pointed and unpointed) word reading, and pseudoword decoding. Consistent with prior literature, that reading pseudowords is the benchmark test of children's phonological decoding skill (Vellutino & Scanlon, 1987; Taouk & Coltheart; 2004), these high correlations among phonological decoding (as measured by pseudoword naming) and oral word reading ability within languages confirms that grapheme-phoneme translation is a fundamental component of reading aloud in Arabic (Abu-Rabia & Siegel, 2003; Geva & Siegel, 2000; Saiegh-Haddad & Geva, 2008).

Table 3: Intercorrelations between oral word reading speed and accuracy and silent reading comprehension in Arabic.

	Comprehension	
	Pointed text	**Unpointed text**
Comprehension **Pointed texts**		0.45**
Speed **Pseudowords**	*-0.13*	*-0.15*
Pointed words	*-0.16*	*-0.15*
Unpointed words	*-0.18*	-0.23**
Accuracy **Pseudowords**	*-0.18*	*-0.18*
Pointed words	*-0.15*	-0.26*
Unpointed words	*-0.1*	-0.29*

**$p < 0.01$ (2-tailed), *$p < 0.05$ (2-tailed).

Among Arabic readers, pseudoword reading was the slowest and least accurate, reading unpointed words was the fastest and the most accurate, while pointed word naming speed and accuracy were in between. The finding that pseudowords are named more slowly and less accurately than real words (the "word-superiority" effect) has traditionally been explained by assuming that words may access the lexicon "directly" by using whole-word orthographic codes, thereby permitting direct access to whole-word phonological information (Coltheart, 1978; Bentin & Ibrahim, 1996). However, when reading pseudowords, the reader must rely extensively on letter-sound conversion rules (Taouk & Coltheart, 2004, Simon, Bernard, Lalonde & Rebai, 2004). This process of pre-lexical phonological assembly is slower and less efficient (e.g., Coltheart, Besner, Jonasson, & Davelaar, 1979; Seidenberg, Waters, Barnes, & Tanenhaus, 1984).

Surprisingly, unpointed words were read aloud more quickly and more accurately than the shallow fully pointed Arabic words. This result might be explained as follows: In fully pointed Arabic, vowels supply a regular and consistent representation that renders any additional linguistic information redundant, especially when readers are not timed (Saiegh-Haddad & Geva, 2008). However, in unpointed Arabic all diacritical marks are absent and vowel identity has to be restored by the reader as an integral part of the word identification process. The disadvantage of pointed words in both speed and accuracy was therefore unexpected, and, furthermore, almost all the participants in the present study reported difficulties reading the pointed Arabic lists employed here, explicitly stating that the vowel signs constituted a hindrance to them. Similarly, when Abu-Rabia and Siegel (2003) tested oral word read ability using pointed words, their 8th grade participants had the same complaint, since all the participants in our study and in Abu-Rabia and Sigel's study typically have had no contact with pointed Arabic script for several years because by the 4th grade pointed texts are gradually phased out. In this line, Roman and Pavard (1987) conducted eye movement studies on two Arabic texts, pointed and unpointed. Findings showed that the text reading processes seem to be impaired when vowels are introduced. Vowels significantly reduced reading speed and significantly increased the number of fixations as well as fixation duration.

Frith (1985) stated that word recognition abilities rest on phonological and orthographic skills and as readers become more proficient they rely more on the use of visual orthographic information (i.e., spelling representations or orthographic codes) than phonological decoding processes and word recognition (Fender, 2008). Therefore, skilled 8th grade readers of Arabic may be shifting away from phonological recoding (which is helped by pointed script) toward an orthographic phase in which

unpointed words that do not contain a complete representation of the individual sounds, can be recognized directly in their visual form, rather than indirectly in terms of their pronunciations (Taouk & Coltheart, 2004). Taouk and Coltheart (2004), set out to determine the degree to which children and adults differentially use phonological recoding and whole-word encoding strategies in reading. They suggested that if skilled adult readers rely on a direct whole-word encoding procedure for reading aloud, and less skilled children readers rely on an indirect recoding procedure that makes use of letter-sound conversion rules, then it would be expected that adults would have greater difficulty reading real words consisting of letters written in their incorrect positions (كَلْب\ كَلْب) than children with adequate knowledge of letter-sound rules. The results indicated that adults were much more disadvantaged than children by the illegal positioning of letters that are foreign to the standard orthographic form of the word.

The second issue addressed in the present study was the effect of vowels on reading comprehension in Arabic. The Arabic reading comprehension results revealed a significant benefit of vowels. Fully pointed Arabic texts were better understood than unpointed texts. This seems to contradict the data from the oral reading tasks. In this context, it is essential to keep in mind that the word reading task was oral, whereas the comprehension task was a silent, meaning-based task. It might be speculated that the availability of precise phonological information offered not only a specific pronunciations but also provide specific meanings of Arabic words, there by disambiguating the identity and meaning of homographic words which are very common (Frost & Bentin, 1992; Ibrahim et al., 2002; Share & Levin, 1999; Abu-Rabia 2001; Shimron, 1993; Taouk & Coltheart, 2004). Ibrahim et al (2002) suggested that the ambiguity of homographs is normally resolved by semantic and syntactic processes in text comprehension. Further, Shimron (1999) suggested that reading strategies relying on contextual sources of information are developed from around third grade onwards because most of the texts encountered by them are unpointed; it seems reasonable therefore that these non-novice readers would adopt reading strategies that rely more heavily on higher-order semantic, pragmatic and contextual information instead of bottom-up phonological decoding. The present results are in line also with prior evidence showing that vowels facilitate reading comprehension in Arabic. Abu-Rabia (1999) tested the effect of vowels on silent reading comprehension in Arabic among second and sixth grade native Arabic speakers. The results showed that vowels facilitated silent reading comprehension in both age groups. Similar results were obtained in a more recent study by Abu-Rabia (2001) among adult native Arabic speakers (L1)

and Hebrew (L2) indicating that vowels facilitate silent reading comprehension in both Arabic and Hebrew. Abu-Rabia reasoned that vowels disambiguated homographs.

A third research question addressed in this study was the relevance of word reading accuracy and fluency to reading comprehension in Arabic among native Arabic speakers' L1. The data provided clear evidence that word reading fluency and accuracy are not substantially correlated with reading comprehension skills. This dissociation between oral word reading and silent reading comprehension results may be attributable to the different demands of each task. Reading aloud a graded list of words is a way of verifying the accuracy of word identification, and does not necessarily involve access to meaning (Baron, 1977; Coltheart, 1978). Furthermore, the pronunciation of the written word appears to depend on exhaustive and fully-specified phonological representations of the type that may not fully correspond to the phonological representations required for silent word recognition and meaning access (Frost, 1998; Share, 2008). In particular, accurate pronunciation of vowel diacritics, which presents unique challenges for the adolescent reader, may be the main source of reading errors in word reading yet this information may not be crucial to meaning access in silent reading comprehension. Oral reading are typically slower than silent reading rates (Barker, Torgesen & Wagner, 1992), consistent with the idea that silent reading involves less exhaustive phonological processing than oral reading. Moreover, overt naming may involve less attention to orthographic structure or to meaning than silent reading (Corcos &Willows, 1993).

More generally, the relation between oral naming of isolated unpointed words and reading comprehension may be problematic for Arabic subjects because the orthography is highly homographic. In this context, Jenkins, Fuchs, Espin, van den Broek, and Deno (2000) tried to evaluate whether reading words in context or in isolation have a similar or different correlation with reading comprehension. Their sample included fourth-grade students: 85 skilled readers, 21 unskilled readers, and 7 students with reading disabilities. Students first read a folktale, and then a word list comprising randomly ordered words from the same text. Performance for each measure was scored as words read correctly per minute. In addition, students completed a reading comprehension test. The results showed that the correlation between reading comprehension and text word reading fluency was .83 compared to .53 for list fluency. The difference between these correlations was significant. However, Levy (2001) compared the effects of word list training versus context training on reading fluency. She reported no differential benefits from list or contextual training.

Finally, another interesting finding emerging in the regression analyses was that reading time for unpointed words was (weakly) correlated with reading comprehension scores in unpointed Arabic texts. This finding is consistent with the hypothesis that unpointed words, even if they are isolated, are recognized by a direct lexical retrieval strategy. In addition, according to Wolf and Katzir-Cohen (2001), word reading only becomes fast and automatic once the reader has developed a strategy of direct word recognition. It seems reasonable to assume that the participants in the present study were competent readers able to recognize and directly retrieve words from the orthographic lexicon. This could explain why in reading isolated lists of pseudowords and pointed words which rely heavily on phonological decoding there was not any significant correlation with reading comprehension scores.

CONCLUSIONS

The whole findings in the current study in reading in Arabic point to a complex relation between word recognition and reading comprehension of written text. It seems that there may be dual functions for vowels: one is the assistance that full phonological information gives the beginning reader, which, for older readers is an impediment because they are no longer familiar with these signs yet unable to ignore them. The other, is the meaning-determining function (Rayner, Foorman, Perfetti, Pesetsky & Seidenberg , 2001) disambiguating homographs, and helping supply semantic-morphological and syntactic information. The present findings support the notion that vowel signs play a central role in Arabic decoding because grapheme-phoneme relations are very complex in Arabic. This means that future research will need to separate the different functions of diacritics in systematic ways and at different stages of reading development. It appears that when dealing with the task of reading comprehension of pointed texts, the Arabic subjects made an extensive use of letter-sound conversion rules to facilitate their reading comprehension performance.

In that regard, the present research adds to the accumulating body of evidence affirming the cognitive complexity of reading written Arabic. The main findings of the present study have general implications for teaching reading in Arabic, both for native Arabic speakers and for learners who are not Arabic native speakers.

Further, our findings in addition to findings of Abdelhadi, Ibrahim and Eviatar (2011) (elated to effects of orthographic complexity and lexical status on vowel detection in Arabic); highlight the fact that other factors

contribute to reading comprehension beyond word naming. Current research suggests that one such factor is morphological awareness. Future research will need to elucidate additional factors. There is now considerable evidence that morphological awareness and text context contributes to the variance in word identification and reading comprehension measures (Seidenberg & MaClelland, 1989; Van Orden, Pennington & Stone, 1990; Abu-Rabia, 2001; Saiegh-Haddad & Geva, 2008). Accordingly, the phonologically-based intervention programs alone may not be sufficient for Semitic languages.

REFERENCES

Abd El-Minem, I.M. (1987). *Elm al-Sarf (Arabic grammer)*. Jerusalem: Al-Taufik Press (in Arabic).

Abdelhadi, S., Ibrahim, R. & Eviatar,. Z. (2011). Perceptual load in the reading of Arabic: Effects of orthographic visual complexity on detection. *Writing Systems Reserach*. *3*, 117—127.

Abu-Ahamad, H., Ibrahim, R., & Share. D.L. (2008). Cognitive Predictors of Early Reading Ability in Arabic: A Longitudinal Study from Kindergarten to Grade 2 In S. Elinor. S & M. Joshi. M. (Eds) *Handbook of Arabic Literacy*. Springer, Dordrecht, Heidlberg, London, New York.

Abu-Rabia, S. & Siegel, L.S. (1995). Different orthographies, different context effects: the effects of Arabic sentence context in skilled and poor readers. *Reading Psychology: An International Quarterly*, *16*, 1-19.

Abu-Rabia, S. (1995). Learning to read in Arabic: Reading, syntactic, orthographic and working memory skills in normally achieving and poor Arabic readers. *Reading Psychology: An International Quarterly*, *16*, 351-394.

Abu-Rabia, S. (1996). The role of vowels and context in reading of highly skilled native Arabic readers. *Journal of Psycholinguistic Research, 25*, 629–641.

Abu-Rabia, S. (1997). Reading in Arabic orthography: the effect of vowels and context on reading accuracy of poor and skilled native Arabic readers in reading paragraphs, sentences, and isolated words. *Journal of Psycholinguistic Research*, *26*, 465-482.

Abu-Rabia, S. (1998). Reading Arabic texts: effects of text type, reader type and vowelization. *Reading and Writing: An Interdisciplinary Journal*, *10*, 105-119.

Abu-Rabia, S. (1999). The effect of Arabic vowels on the reading comprehension of second and sixth-grade native Arabic children. *Journal of Psycholinguistic Research*, *28*, 93-101.

Abu-Rabia, S. (2000). Effects of exposure to literary Arabic on reading comprehension in a diglossic situation. *Reading and Writing: An Interdisciplinary Journal, 13,* 147–157.

Abu-Rabia, S. (2001). The role of vowels in reading Semitic scripts: Data from Arabic and Hebrew. *Reading and Writing: An Interdisciplinary Journal*, *14*, 39–59.

Abu-Rabia, S. (2002). Reading in a root-based-morphology language: The case of Arabic. *Journal of Research in Reading, 25*, 299–309.

Abu-Rabia, S., Share, D., & Mansour, M. (2003). Word recognition and basic cognitive processes among reading-disabled and normal readers in Arabic.Reading and Writing: *An Interdisciplinary Journal, 16*, 423–442.

Abu-Rabia, S. & Siegel, L.S. (2003). Reading skills in three orthographies: The case of trilingual Arabic-Hebrew-English-speaking Arab children. *Reading and Writing, 16,* 611-634.

Adams, M. J. (1990). *Beginning to read: Thinking and learning about print*. Cambridge, MA: MIT Press.

Ayari, M., & Wimmer, H. (2003). Learning to read: English in comparison to six more regular orthographies. *Applied Psycholinguistics*, *24*, 621-635.

Ayari, S. (1996). Diglossia and illiteracy in the Arab world. *Language, Culture and Curriculum, 9*, 243-253.

Azzam, R. (1989). In the linguistics of literacy, Orthography and reading of the Arabic languge. In J. Aaron & R. M. Joshi (Eds.), *Reading and writing disorders in different orthographic systems,* 203-218.

Azzam, R. (1993). The nature of Arabic reading and spelling errors of young children. *Reading and Writing, 5,* 355–385.

Badry, F. (1983). *Acquisition of lexical derivational rules in Moroccan Arabic: Implications for the development of standard Arabic as a second language though literacy*. Unpublished doctoral dissertation. University of California, Berkeley.

Barker, A., Torgesen, K. & Wagner, K. (1992). The role of orthographic processing skills on five different reading tasks. *Reading Research Quarterly*, *27*, 334-345.

Baron,J. (1977). Mechanisms for pronouncing printed words: Use and acquisition. In D. LaBerge & S.J. Samules (Eds.), *Basic processes in reading: Perception and comprehension*. Hillsdale, NJ:Erlbaum.

Beeston, A. (1968). *Written Arabic: An Approach to Basic Structures*. Cambridge University Press.

Ben-Dror, I., Bentin, S. & Frost, R. (1995). Semantic, phonologic, and morphologic skills in reading-disabled and normal children: evidence from perception and production of spoken Hebrew. *Reading Research Quarterly, 30*, 876–893.

Bentin, S., & Ibrahim, R. (1996). New evidence for phonological processing during visual word recognition: The case of Arabic. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 22,* 309–323.

Biemiller, A. (1970). The development of the use of graphic and contextual information as children learn to read. *Reading Research Quarterly, 6,* 75-96.

Coltheart, M. (1978). Lexical access in simple reading tasks. In: G. Underwood (Eds.), *Strategies of information processing (*pp. 151-216). San Diego, CA: Academic Press.

Coltheart, M., Besner, D., Jonasson, J. T., & Davelaar, E. (1979). Phonological recording in the lexical decision task. *Quartery Journal of experimental Psychology, 31,* 489-507.

Corcos, E.., & Willows, D.M. (1993). The processing of orthographic information. In D. M. Willows, R. S. Kruk, & E. Corcos (Eds.*), Visual processes in reading and reading disabilities* (pp. 163-188). Dordrecht/Boston/London: Kluwer Academic Publishers.

Cziko, G.A. (1980). Language competence and reading strategies: A comparison on first- and second-language oral reading errors. *Language Learning, 30,* 101-114.

Ehri, L. (2005). Learning to read words: Theory, findings, and issues. *Scientific Studies of Reading*, *9*, 167–188.

Eviatar, Z. & Ibrahim, R. (2004). Morphological and orthographic effects on hemispheric processing of nonwords: A Cross-linguistic comparison. *Reading and Writing*, *17*, 691-705.

Eviatar, Z., & Ibrahim, R. (2001). Bilingual is as bilingual does: Metalinguistic abilities of Arabic-speaking children. *Applied Psycholinguistics, 21,* 451-471.

Eviatar, Z., Ibrahim, R., & Ganayim, D. (2004). Orthography and the hemispheres: Visual and linguistic aspects of letter processing. *Neuropsychology, 18,* 174-184.

Feitelson, D., Kita, B., & Goldstein, K. (1986). Effects of listening to stories on first graders' comprehension and use of language. *Research in the Teachind of English, 20,* 339-356.

Fender, M. (2008). Spelling knowledge and reading development: Insights from Arab ESL learners. *Reading in a Foreign Language*, *20*, 19-42.

Ferguson, C. (1959). Diglossia. *Word*, *15*, 325-337.

Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. patterson, J. Marshall, & M. Clotheart (Eds*). Surface dyslexia* (pp. 301-330). Hillsdale, NJ: Erlbaum.

Frost, R. (1994). Prelexical and postlexical strategies in reading: Evidence from deep and shallow orthography. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 20*, 116-129.

Frost, R. (1995). Phonological computation and missing vowels: Mapping lexical involvement in reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 31,* 398-408.

Frost, R. (1998). Toward a strong phonological theory of visual word recognition: True issues and false trails. *Psychological Bulletin, 123,* 71-99.

Frost, R. (2005). Orthographic systems and skilled word recognition processes in reading. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: A handbook* (pp. 272-295). Oxford, UK: Blackwell.

Frost, R., & Bentin, S. (1992). Reading consonants and guessing vowels: Visual word recognition in Hebrew orthography. In R. Frost & L. Katz (Eds), *Orthography, phonology, morphology, and meaning* (pp. 27-44). Amsterdam: North-Holland.

Fuchs, L.S., Fuchs, D., Hosp, M.K., & Jenkins, J.R. (2001). Oral reading fluency as an indicator of reading competence: A theoretical, empirical, and historical analysis. *Scientific Studies of Reading, 5*, 241-258.

Geva, E., & Siegel, S. (2000). Orthographic and cognitive factors in the concurrent development of basic reading skills in two languages. *Reading and Writing: An Interdisciplinary Journal, 21*, 1-30.

Haeri, N. (1996). *The Sociolinguistic Market of Cairo: Gender, Class, and Education*. London: Kegan Paul International.

Hoover, W., & Gough, P.B. (1990). The simple view of reading. *Reading and Writing: An Interdisciplinary Journal, 2,* 127-160.

Hudson, A. (1991). Toward the systematic study of diglossia. *Southwest Journal of Linguistics, 7*, 5-15.

Hudson, A. (2002). Outline of a Theory of Diglossia. *The International Journal of the Sociology of Language, 157,* 1-46.

Ibrahim, M. H. (1983). Linguistic distance and literacy in Arabic. *Journal of Pragmatics, 7*, 507-515.

Ibrahim, R. (2008). Does visual and Auditory Word Perception have a Language-Selective Input? Evidence from Word Processing in Semitic languages. *Linguistic Journal, 3,* 82-103.

Ibrahim, R. (2009). The cognitive basis of diglossia in Arabic: Evidence from a repetition priming study within and between languages. *Psychology Research and Behavior Management*, *12*, 95-105.

Ibrahim, R., & Aharon-Peretz, J. (2005). Is literary Arabic a second language for native Arabic speakers? : Evidence from a semantic priming study. *The Journal of Psycholinguistic Research, 34*, 51-70.

Ibrahim, R., & Eviatar, Z. (2001). The effects of metalinguistic awareness on the acquisition of reading: a cross-language comparison. Manuscript submitted for publication.

Ibrahim, R., & Eviatar, Z., & Aharon-Peretz, J. (2002). The Characteristics of Arabic orthography slows its processing. *Neurosychology, 16,* 322-326.

Ibrahim, R., Eviatar, Z., & Aharon-Peretz, J. (2007). Metalinguistic awareness and reading performance: A cross-language comparison. *Journal of Psycholinguistic Research, 36,* 297-317.

Ibrahim, R., Iaraeli, N., & Eviatar, Z. (2010). Hemispheric involvement in reading: The effects of language experience. *Journal of Neurolingistic, 23,* 247-442.

Iraqi, J. (1990). *Reading to Arabic-speaking kindergarten children compared to alternative enrichment activities as a means of improving listening comprehension and language skills*. Unpublished Master's Thesis, University of Haifa, Haifa, Israel.

Jenkins, J. R., Fuchs, L. S., Espin, C., van den Broek, P., & Deno, S. L. (2000). *Effects of task format and performance dimension on word reading measures: Criterion validity, sensitivity to impairment, and context facilitation*. Manuscript submitted for publication.

LaBerge, D., & Samuels, S.J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology, 6*, 293-323.

Levy, B.A. (2001). Moving the bottom: Improving reading fluency. In M. Wolf (Eds.), *Dyslexia, fluency, and the brain*. (pp. 357-382). Parkton, MD: York Press.

Maamouri, M. (1998). *Language Education and Human Development: Arabic diglossia and its impact on the quality of education in the Arabic region*. Discussion paper prepared for the World Bank Mediterranean Development Forum, Marrakech. Philadelphia: University of Pennsylvania International Literacy Institute.

Navon, D., & Shimron, Y. (1984). Reading Hebrew: How necessary is the graphemic representation of vowels? In L. Henderson (Eds.), *Orthographies and reading: Perspectives from cognitive psychology, neuropsychology, and linguistics*. London: Erlbaum.

Oakhill, J.V., Cain, K., & Bryant, P.E. (2003). The dissociation of word reading and text comprehension: Evidence from component skills. *Language and Cognitive Processes*, *18*, 443-468.

Oren, S. (2001) Hebrew. *The perception of Arabic orthography by native speakers: Identification of writing mistakes, their correction and explanation*. Unpublished MA thesis. Tel-Aviv, Israel: Tel-Aviv University, School of Education.

Pazzaglia, F., Cornoldi, C., & Tessoldi, P.E. (1993). Learning to read: Evidence on the distinction between decoding and comprehension skills. *European Journal of Psychology in Education, 8,* 247-258.

Perfetti, C. (1985). *Reading ability*. New York: Oxford University Press.

Perfetti, C.A. (1986). Continuities in reading acquisition, reading skill, and reading disabilities. *Remedial and Special Education, 7,* 11-21.

Perfetti, C.A. (1992). The representation problem in reading acquisition. In P.B. Gough, L.C. Ehri & R. Treiman (Eds.), *Reading acquisition* (pp. 145-174). Hillsdale, New Jersey: Erlbaum.

Perfetti, C.A. (1995). Cognitive research can inform reading education. *Journal of Research in Reading, 18*, 106-115.

Rayner, K., Foorman, B. R., Perfetti, C. A., Pesetsky, D., & Seidenberg, M. S. (2001). How psychological science informs the teaching of reading. *Psychological Science in the Public Internet, 2,* 31-74.

Roman, G., & Pavard, B. (1987). A comparative study: How we read Arabic and French. In J. K. O'Regan & A. Levy-Schoen (Eds.), *Eye movements: From physiology to cognition* (pp. 431-440). Amsterdam' The Netherlands: North Holland Elsevier.

Saiegh-Haddad, E. (2003). Linguistic distance and initial reading acquisition: the case of Arabic diglossia. *Applied Psycholinguistics, 24*, 115-135.

Saiegh-Haddad, E. (2004). The impact of phonemic and lexical distance on the phonological analysis of word and pseudowords in a diglossic context. *Apply Psycholinguist*, *25*, 495-512.

Saiegh-Haddad, E. (2005). Correlates of reading fluency in Arabic: Diglossic and orthographic factors. *Reading and Writing*, *18*, 559-582.

Saiegh-Haddad, E., & Geva, E. (2008). Morphological awareness, phonological awareness, and reading in English-Arabic bilingual children. *Reading and Writing, 21,* 481-504.

Seidenberg, M. S., Waters, G. S., & Barnes, M.A. (1984). When does irregular spelling or pronunciation influence word recognition? *Journal of Verbal Learning and Verbal Behavior, 23,* 383-404.

Seidenberg, M.S., & McClelland, J.L. (1989). A distributed developmental model of word recognition and naming. *Psychological Review, 96*, 523-568.

Shankweiler, D. (1989). How problems of comprehension are related to difficulties in word reading. In D. Shankweiler & I.Y. Liberman (Eds.*), phonology and reading disability: Solving the reading puzzle* (pp.35-68). Ann Arbor: University of Michigan Press.

Share, D.L. (2008). On the Anglocentricities of Current Reading Research and Practice: The Perils of Overreliance on an "Outlier" orthography. *Psychological Bulletin*, *134(4),* 584-615.

Share, D.L., & Levin, I. (1999). Learning to read and write in Hebrew. In M. Harris & G. Hatano (Eds.). *Learning to read and write: A cross-linguistic perspective* (pp. 98-111). New York: Cambridge University Press.

Shimron, J. (1993). The role of vowels in reading: A review of studies of English and Hebrew. *Psychological Bulletin, 114*, 52-67.

Shimron, J. (1999). The role of vowel signs in Hebrew: Beyond word recognition. *Reading and writing: An Interdisciplinary Journal, 11,* 301-319.

Simon, G., Bernard, C., Largy, P., Lalonde, R., & Rebai, M. (2004). Chronometry of visual word recognition during passive and lexical decision tasks: An ERP investigation. *International Journal of Neuroscience, 114,* 1401-1432.

Snow, C.E., & Sweet Polselli, A.P. (2003). Reading for comprehension. In A. P. Sweet & C.E. Snow (Eds.), *Rethinking reading comprehension*. New-York, NY: The Guilford Press.

Stanovich, K.E. (1991). Word recognition: Changing perspectives. In R. Barr, M.L. Kamill, P.B. Mosenthal, & P.D. Pearson (Eds.), *Handbook of Reading Research*, (pp. 418-452). New-York: Longman.

Taouk, M., & Coltheart, M. (2004). The cognitive processes involved in learning to read in Arabic. *Reading and Writing: An Interdisciplinary Journal, 17,* 27-57.

Van Orden, G.C., Pennington , B.F. & Stone, G.O. (1990). Word identification in reading and the promise of subsymbolic psycholinguistics. *Psychological Review, 97,* 488-522.

Velluntino, F., & Scanlon, D. (1987). Phonological coding, phonological awareness, and reading ability: Evidence from a longitudinal and experimental study. *Merrill-Palmer Quarterly, 33,* 321-363.

Wolf, M. & Katzir-Cohen, T. (2001). Reading fluency and its intervention. *Scientific Studies of Reading, 5*, 211–239.

(Manuscript received: 19 July 2013; accepted: 13 January 2014)