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THE SIMPLE VIEW OF READING MODEL IN THE TRANSPARENT AND DEEP VERSIONS OF ARABIC ORTHOGRAPHY

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Several studies have tested the validity of the simple view of reading model by examining various degrees of orthographic depth. This study aims to validate this model in both transparent and deep versions of Arabic. In addition, the contribution of the basic components of decoding and listening comprehension to reading comprehension in the transparent and deep versions was tested. In total, 460 typical Arabic-speaking children in the first and second grade participated in this study. A moderate degree of explained variance was found in both versions, and the contribution of decoding and listening comprehension was influenced by transparency and by the grade level of the reader. The results are discussed in relation to previous findings in the field and the unique characteristics of the Arabic language.

The simple view of reading proposed by Gough and Tunmer (1986) and Hoover and Gough (1990) is among the most common models of reading comprehension. The simple view of reading model posits that reading comprehension is a product

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of decoding and linguistic comprehension. The first of these components, decoding, refers to the ability to convert graphemes to phonemes and is usually measured by accurate word (and non-word) reading (Chen & Vellutino, 1997). The second component, linguistic comprehension, refers to the ability to process and understand spoken language and is measured by listening comprehension. These two basic components are necessary for reading comprehension, but neither alone is sufficient (Gough & Tunmer, 1986).

The validity of the simple view of reading model has been widely tested among English speakers. Globally, this model has been reported to explain 40–83% of the variance in reading comprehension (Braze et al., 2016; Chen & Vellutino, 1997; Joshi & Aaron, 2000; Kershaw & Schatschneider, 2012; Oakhill & Cain, 2012; Ouellette & Beers, 2010). These findings have been replicated in languages other than English, including French (Megherbi, Seigneuric, & Ehrlich, 2006), Greek (Protopapas, Sideridis, Simos, & Mouzaki, 2007), Italian (Carretti & Zamperlin, 2010), and Spanish (Nakamoto, Lindsey, & Manis, 2008), and even in languages with non-Latin orthographic systems, such as Chinese (Joshi, Tao, Aaron, & Quiroz, 2012), Hebrew (Joshi, Ji, Breznitz, Amiel, & Yulia, 2015) and Arabic (Asadi, Khateb, & Shany, 2017). However, because this model mainly relies on two components, i.e., decoding and listening comprehension, and languages differ in their orthographic depth (Ziegler & Goswami, 2005), the way, rate, and ease by which decoding and LC develop and influence reading comprehension may differ across languages, particularly during the early stages of reading development (Catts, Hogan, & Adlof, 2005).

Indeed, several researchers argue that the decoding component is stronger in younger children & tends to decrease as readers grow older (Duke, Pressley, & Hilden, 2004; Garcia & Cain, 2014; Vellutino, Tunmer, Jaccard, & Chen, 2007), whereas the listening comprehension contribution tends to increase with the age of the reader (Catts et al., 2005; Chen & Vellutino, 1997). The rationale of these changes in the relative contribution of decoding and listening comprehension to reading comprehension is that beginners, i.e., children starting

school, already have a certain level of verbal or linguistic knowledge, but they must also acquire entirely new knowledge that involves printed words and decoding. Once children master decoding, listening comprehension plays a more critical role in predicting reading comprehension (Catts et al., 2005; Vellutino et al., 2007). However, in orthographies that require several years of reading instruction, decoding continues to be a dominant predictor of reading comprehension (Chen & Vellutino, 1997; Florit & Cain, 2011). In contrast to these findings, other studies have found that the contribution of decoding and listening comprehension to reading comprehension was comparable between English-speaking children in first and second grade (Foorman, Herrera, Petscher, Mitchell, & Truckenmiller, 2015) and more skilled readers (Sabatini, Sawaki, Shore, & Scarborough, 2010). Nevertheless, the role of orthographic transparency in the contribution of both decoding and listening comprehension to reading comprehension should not be ignored (Florit & Cain, 2011; Tobia & Bonifacci, 2015).

The high consistency of grapho-phonemic correspondence in transparent orthographies (e.g., Greek and Italian) facilitates reading development and allows young readers to master decoding by the end of first grade (Lappanen, Aunola, Niemi, & Nurmi, 2008; Papadopoulos, Spanoudis, & Kendeou, 2009) and to reach high levels of accuracy (94% in Italian (See Cossu, Gugliotta, & Marshall, 1995). Given the early ceiling effect of accuracy in transparent orthography (Seymour, Aro, & Erskine, 2003), listening comprehension becomes the more powerful predictor (Vellutino et al., 2007). In fact, several studies investigating transparent orthographies have reported that the listening comprehension contribution to reading comprehension was critical even in the first and second grades (Tobia & Bonifacci, 2015; Florit & Cain, 2011). In our previous study, we tested the simple view of reading model in the vowelized Arabic orthography in children in first to sixth grades (using other samples and measures) and revealed that the contributions of listening comprehension and decoding to reading comprehension were similar in the first grade ($\beta = .43$). In addition, although vowelized Arabic is considered a transparent orthography (see below), the contribution of decoding to reading comprehension was significant in

all grades, and a slightly decreasing trend was observed between first grade ($\beta = .43$) and sixth grade ($\beta = .35$), which is not expected in transparent orthographies (Asadi et al., 2017). In less transparent orthographies (e.g., English and French), decoding is more challenging due to the ambiguity of grapho-phonemic correspondence, and young learners require more time for reading acquisition (Seymour et al., 2003; Ziegler & Goswami, 2005). Consequently, the contribution of decoding to reading comprehension in deep orthographies may extend to higher grades (Florit & Cain, 2011).

Based on the above review and despite empirical studies supporting the simple view of reading model in various languages, we conclude that the explained variance and weight of the contribution of decoding and listening comprehension to reading comprehension may depend on different unique characteristics, such as the orthographic depth/transparency of the studied language. Arabic orthography is an alphabetic system that is written from right to left and includes 28 letters, all of which are consonants except for three long vowels. In addition, the vowelization system represents the short vowels, which are presented as diacritics, i.e., marks added above and below the letters (Asadi, Ibrahim, & Khateb, 2017; Taha, 2013). Additionally, Arabic orthography is characterized by a certain visual density and great similarity among the letters, with the variations between letters appearing as minor features, such as the presence or absence of diacritic marks <"ر"/"ز"> (for/z/and/r/), their position below or above the letters <"ن"/"ب"> (for/b/and/n/), and their number <"ت"/"ث"> (for/◆/and/th/).

Arabic orthography (similar to Hebrew) varies in depth; vowelized Arabic (including short vowels) is considered a transparent orthography, while non-vowelized Arabic is considered a deep orthography (Abu-Rabia, 2001) with only consonants and long vowels, leading to the creation of homographic words, i.e., words that are similar in their orthographic appearance but represent phonologically different words and meanings (for example, the word "قدم"/*qdm*/can be pronounced/*qadam*/, meaning "foot", or/*qadima*/, meaning "arrive"). Children begin by reading the vowelized (transparent) version, and, around

the fourth grade, they begin to read the non-vowelized (deep) version (Asadi et al., 2017).

In addition to the orthographic uniqueness that may influence the extent of decoding in the simple view of reading model in Arabic, diglossia may also influence the listening comprehension contribution to the simple view of reading model. Diglossia in Arabic refers to the existence of the following two forms of the same language (Ferguson, 1959): the spoken form and the literary form, also called modern standard Arabic (Saiegh-Haddad & Joshi, 2014), which are used in different situations. Children mainly use the spoken version for oral communication during the pre-school period, although they may be exposed to the literary version *via* a few television programs. However, after children start school, they begin to use the literary version through formal and more systematic instruction. Notably, the printed word only represents the literary language. The discrepancy between the spoken and literary forms is reflected at the following different linguistic levels: phonological, morphological, semantic, and syntactic (Saiegh, 2003). Thus, while children who speak other languages begin school with fairly mature linguistic knowledge, given the diglossic reality, Arabic children may exhibit immaturity in their oral literary language (Saiegh-Haddad & Joshi, 2014), and, consequently, the relative predictive power of listening comprehension in reading comprehension may differ in Arabic children.

Accordingly, given both the unique and challenging orthographic system and the diglossic situation, the relative contribution of decoding and listening comprehension in predicting reading comprehension may be different in Arabic than in other languages and may also differ between the initial stage of reading development (first grade) and more advanced stages (second grade). Thus, to assess the cross-validity of the simple view of reading model, additional studies investigating languages that differ in their orthographic systems (other than Latin) and their transparency are needed (Florit & Cain, 2011). Testing the simple view of reading model in Arabic could generally benefit our understanding of this model. Arabic is among the few languages, with both transparent

(vowelized) and deep (non-vowelized) orthographic system. Therefore, in this study, we tested the simple view of reading model in both the transparent and deep orthographic systems of Arabic in children in both the first and second grade. This study can provide a more robust rationale for the differences noted between languages with transparent and less transparent orthographies. In addition, this study tested the consistency of this model.

Methods

Participants

A total of 460 Arabic-speaking children (209 boys) were recruited from 33 Arab elementary schools in North, Central, and South Israel. Two cohorts of first and second graders (229 and 231, respectively), participated in this study, which was conducted in May and June (i.e., toward the end of the school year) to ensure that all first-grade children could perform the reading tasks. The mean age of the first graders was 84.6 months ($SD = 7.3$), and the mean age of the second graders was 97.1 months ($SD = 8.4$). All children were enrolled in regular classes, and, according to their teachers, none of the children were in special education or had visual, hearing, language, or learning disabilities.

Measures

According to the simple view of reading model, the children were assessed using measures of reading comprehension, listening comprehension, and decoding. The measures of decoding and reading comprehension were performed in both the vowelized/transparent and non-vowelized/deep versions of the language. Real words were chosen for this study because pseudowords in the non-vowelized form often become homographic and, thus, can be read correctly while pronounced in different ways, which may influence their reliability. All measures were age-appropriate based on the judgment of five first and second grade teachers.

READING COMPREHENSION

Three passages were devised for the reading comprehension task. The first passage was a narrative text consisting of 41 vowelized words. The second passage was an informative text consisting of 64 vowelized words. The third passage was a narrative text consisting of 68 vowelized words. Six multiple-choice questions (also vowelized) were prepared for each passage. In addition, an identical, non-vowelized version of the same passages and questions was also created. The children were required to read silently and then answer six multiple-choice questions after reading each passage. Each participant's score was based on the total number of correct answers regarding all three passages, and the maximum possible score was 18. The reliability of the reading comprehension texts (Cronbach's α) was 0.78 for the vowelized version and 0.79 for the non-vowelized version.

LISTENING COMPREHENSION

Two listening comprehension texts were devised to test the first and second-grade children. The first text was a narrative text consisting of 46 words, while the second text was informative and contained 60 words. Eight multiple-choice questions were devised for each text. In both texts, immediately after the examiner had read the passage twice, the participants were required to answer multiple-choice questions, which were also presented orally by the examiner. Each participant's score was based on the total number of correctly answered questions, with a maximum score of 16. The reliability of this test (Cronbach's α) was 0.63 in the first-grade children and 0.65 in the second-grade children.

DECODING

Similar to the reading comprehension task, two vowelized and non-vowelized lists of real words were devised. Thirty fully vowelized words, representing several morphological patterns in Arabic, were presented in the first list, while the second list included the same words in the non-vowelized form. The words varied in length (2–4 syllables) and frequency (low, medium, and high frequency). The participants were required to read the words aloud as accurately as possible at a rate that suited them. Each participant's score was based on the total number of correctly read items, with a maximum score of 30. The

reliability (Cronbach's α) of the vowelized version was 0.90, and the reliability of the non-vowelized version was 0.91.

The participants were tested individually by an examiner in a quiet room over two meetings. However, several pauses were given to prevent fatigue, particularly because the participants were first and second grade children. After randomly selecting 460 children, half of the children performed the tasks in the vowelized/transparent version, and the other half performed the tasks in the non-vowelized/deep version. All examiners were from the field of education and had received specific and intensive training regarding the procedures and administration of the tasks.

Results

The descriptive statistics of the raw scores of the reading comprehension, listening comprehension, and decoding achieved by the first and second graders are presented in Table 1. The mean scores of all three variables were highly similar in both the vowelized/transparent and non-vowelized/deep versions and were acceptable, and no indications of floor or ceiling effects were observed. In addition, the developmental changes (between the grades) were significant for all three variables ($p < .001$), which may strengthen their validity. The Pearson correlations of each grade and version are presented in Table 2. All correlations were highly significant ($p < .001$), except for listening comprehension and decoding ($p < .05$) in the vowelized/transparent version in the first graders and

TABLE 1 Descriptive Statistics of Raw Scores Mean and SD

	Vowelized/transparent		Non-Vowelized/deep		
Variables	Grade 1[a]	Grade 2[b]	Grade 1[a]	Grade 2[b]	Max
RC	13.0 (3.7)	15.3 (2.7)	13.1 (3.4)	16.0 (2.0)	18
LC	10.8 (2.7)	12.3 (1.9)	11.1 (2.5)	12.8 (1.9)	16
Decoding	18.7 (7.2)	22.8 (6.1)	17.8 (7.1)	22.9 (5.2)	30

RC: reading comprehension; LC: listening comprehension.
[a] $n = 229$; [b] $n = 231$.

non-vowelized/deep version in the second graders. The correlations between reading comprehension and listening comprehension were the highest but decreased with the age of the children in both versions. Moderate correlations were observed between reading comprehension and decoding. However, while this correlation exhibited a decreasing trend with age in the vowelized/transparent version, an opposite, ascending trend was observed in the non-vowelized/deep version.

Separate linear regression analyses were performed for the vowelized/transparent version and non-vowelized/deep version in the first and second graders. In both models, reading comprehension was the dependent variable, and listening comprehension and decoding were the independent variables. As

TABLE 2 Correlation Analyses of all Variables in Transparent and Deep Arabic Orthographies

	Vowelized/ transparent		Non-Vowelized/deep	
	LC	Decoding	LC	Decoding
Grade 1[a]				
RC	.69**	.34**	.59**	.37**
LC		.23*		.31**
Grade 2[b]				
RC	.65**	.25**	.46**	.54**
LC		.29**		.19*

RC: reading comprehension; LC: listening comprehension.
*$p < .05$; **$p < .01$.
[a]$n = 229$; [b]$n = 231$.

TABLE 3 Regression Results for Simple View of Reading in Transparent and Deep Arabic Orthographies

	Vowelized/transparent		Non-vowelized/deep	
Grade	LC	Decoding	LC	Decoding
Grade 1[a]				
Beta	.65***	.21**	.53***	.18*
R^2		.52***		.38***
Grade 2[b]				
Beta	.63***	.07	.38***	.45***
R^2		.42***		.43***

RC: reading comprehension; LC: listening comprehension.
*$p < .05$; **$p < .01$; ***$p < .001$.
[a]$n = 229$; [b]$n = 231$.

presented in Table 3, the explained variance of reading comprehension in the vowelized/transparent version was higher in the first graders (52%) but decreased in the second graders (42%). This decreasing trend was not related to the listening comprehension contribution, which was found to be substantial and stable with age, but was related to the disappearance of the decoding contribution in the second graders (β=.07; $p > .05$). In the non-vowelized/deep version, the explained variance of reading comprehension in the first graders) 38%) was more modest than that in the vowelized/transparent version. However, despite the decrease in the listening comprehension contribution in the second graders, ascending trends in the explained variance and the decoding contribution was observed with age in the non-vowelized/deep version.

Discussion

This study aimed to cross-validate the simple view of reading model in Arabic throughout the early stages of reading acquisition. This validity was tested using the same methods with both vowelized/transparent and non-vowelized/deep versions of Arabic orthographies. The findings reveal that listening comprehension and decoding explain a moderate amount of the variance in reading comprehension in both versions, confirming the cross-orthographic validity of the simple view of reading model to a certain extent. These findings are consistent with previous studies investigating transparent (Asadi et al., 2017; Carretti & Zamperlin, 2010; Joshi et al., 2015; Tobia & Bonifacci, 2015) and deep (Megherbi et al., 2006; Ouellette & Beers, 2010) orthographies. Unlike in the original model of simple view of reading, the explained variance of reading comprehension was moderate and even modest in the non-vowelized/deep version, which may be due to the differences in the orthographic system (non-Latin symbols) and tools (words vs. pseudowords); however, our sample included only skilled readers with no representation (or over-representation) of disabled readers. Moreover, the moderate amount of explained variance in reading comprehension could indicate that additional variables are needed when testing reading comprehension. Indeed, studies investigating Arabic

orthography using only the vowelized/transparent version in children in similar grade levels showed that orthographic and morphological knowledge add 10% of explained variance to decoding and listening comprehension (Asadi et al., 2017).

The strength and trend of the explained variance of reading comprehension were influenced by transparency. More specifically, the explained variance in the vowelized/transparent version was the highest in the first graders (52%) but decreased as the children grew older. Conversely, in the non-vowelized/deep version, the explained variance of reading comprehension in the first graders was relatively modest (38%) and less than that found in the vowelized/transparent version but increased with the age of the children. Additionally, as shown by the standardized coefficients, the predictive variables revealed differences in the strength and consistency of the prediction. Specifically, the decoding contribution in the vowelized/transparent version became insignificant as the children progressed from the first to the second grade, but, in the non-vowelized/deep version, the decoding contribution significantly increased with age. A similar trend was observed in the correlation analysis. This pattern supports the view that decoding plays a more critical role in more deep orthographies, whereas the reading process becomes more challenging due to the non-predictable, grapho-phonemic correspondence (Seymour et al., 2003). However, in the transparent orthographies, full phonological information is available, helping the children acquire reading skills by the end of the first grade (Papadopoulos et al., 2009); therefore, the decoding contribution is less necessary in second grade.

While the listening comprehension contribution was strong and consistent in the vowelized/transparent version, this contribution was lower in the non-vowelized/deep version and decreased as the children aged. This trend also appeared in the correlation analysis. The high and consistent contribution of listening comprehension to reading comprehension in the vowelized/transparent version is consistent with other findings in this age group in transparent orthographies, such as Hebrew (Joshi et al., 2015), Italian (Carretti & Zamperlin, 2010; Tobia & Bonifacci, 2015), and Norwegian (Høien-Tengesdal, 2010). The superiority of the listening comprehension contribution

relative to that of decoding in the vowelized/transparent version and even in the non-vowelized/deep version in the first graders did not support the hypothesis that decoding is a dominant predictor of reading comprehension during the early stages of reading acquisition (Florit & Cain, 2011). In addition, listening comprehension is considered fully operative and critical to reading comprehension only after decoding skills are mastered (Vellutino et al., 2007). Nevertheless, listening comprehension in the diglossic reality of Arabic could be reflected differently than in other languages. To recall, listening comprehension, in languages other than Arabic, is tested by using the same oral language that children have always known and used. This reality is not valid for Arab children since their literary (oral) language, used in reading and listening comprehension, is different from their spoken (oral) language. Yet, some have argued that because of diglossia, Arab-speaking children probably start school with immaturity in their oral (literary) language (Saiegh-Haddad & Joshi, 2014).

The changes with age in the explained variance and the standardized coefficients of decoding and listening comprehension in both versions highlight that the simple view of reading model is not highly sensitive to the relevant contribution of these predictors at different ages (Ripoll Salceda, Aguado Alonso, and Castilla-Earls, 2014). Our findings support the hypothesis that this contribution is dynamic and changes with age (Kershaw & Schatschneider, 2012) and that the trend in these changes depends on orthographic transparency (Florit & Cain, 2011). Finally, the similarity in the performance of decoding (and reading comprehension) in both the vowelized/transparent and non-vowelized/deep versions is consistent with previous studies in which vowelization did not significantly affect reading accuracy in either beginner or skilled readers (Asadi, 2017; Asadi & Khateb, 2017; Saiegh-Haddad & Schiff, 2016; Taha, 2016). Moreover, this similarity may suggest that transparency in Arabic should not be determined only by the existence of vowels but by the consistency between the written and spoken language. Indeed, considerable unpredictable grapho-phonemic correspondence still exists, even in vowelized Arabic scripts, due to the other characteristics of the Arabic orthographic system,

such as the fact that several sounds can be represented in different ways and that several graphemes can be written but not pronounced and vice versa. Altogether, the relationship between letters and sounds is ambiguous, even in vowelized orthography.

In conclusion, the simple view of reading model which was initially tested in the English language could explain a relatively limited amount of variance in the two versions of Arabic orthography. Also, this study showed that the contribution of decoding and listening comprehension could differ as a function of the orthographic depth, suggesting that differences between transparent and deep orthographies and between beginner and skilled readers should not be ignored when assessing the validity of this model. Moreover, the considerable unexplained variance in reading comprehension in both versions highlights the necessity for more complex, multi-variable models in future research on reading comprehension in general, and particularly in Arabic in view of its complex orthographic system and diglossic situation. Nevertheless, both decoding and listening comprehension results are essential to reading comprehension in the first grade, which may require that more activities in listening comprehension, rather than decoding, should be the focus of educational programmers and be included in the curriculum of the first and second grades. Yet, intervention programs in Arabic could benefit if they were to focus also on listening comprehension. Although reading in non-vowelized Arabic orthography was previously tested in children in the early grades (Asadi, 2017; Saiegh-Haddad & Schiff, 2016; Taha, 2016), its inclusion reflects a possible limitation of this study. This is an atypical situation designed to compare different degrees of orthographic depth in the same language. Accordingly, caution is necessary for interpreting these differences. Additionally, future studies should investigate such differences in typical situations, which would necessitate starting with third and fourth graders. Finally, more studies are needed to investigate the large and unexplained variances in reading comprehension in Arabic.

DISCLOSURE STATEMENT

The authors declare that they have no conflict of interest.

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