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The Contribute of the Word Roots in Reading among Normal and Dyslexic Readers

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Abstract: The aim of the present work is to stress the contribute of the word roots in reading among normal and dyslexic readers. The lexical status of the root morphemes were examines using two priming paradigms: the masked priming; and the cross-modal immediate repetition task among regular and dyslexic readers: Grades sixth, eighth and tenth. The hypothesis was that the roots of words are lexical entities which have a role in organizing the lexicon, and facilitate the access to a wide countenance of verbs among regular and dyslexic readers from ages of elementary to high school. It was also assumed that the effect of visual morphological priming and effect of auditory morphological priming will be stronger among those who have a reading disability and among young readers, compared to more skilled readers. Further, it was assumed that the manner of representation of morphologically complex words and how to access them is similar among the all readers in reading Arabic. In addition, it was assumed that the pace of building a mental lexicon among dyslexic readers is slow, but the lexicon itself is similar to that of regular readers. The findings confirmed the first hypothesis about the roots. It was also found that regarding readers with dyslexia, the manner of representation of the words that are morphologically complex is different compared to regular readers. It was concluded that this difference is a result of a deficit in the initial processing process among these readers, and that they are apparently relying on other channels except the morphological one when identifying verbs, which emphasizes the uniqueness of the Arabic language, its morphological density and its phonological and lexical richness.

Keywords: Root morphemes, Priming paradigm, Lexical status, Dyslexic readers, Morphological awareness

Introduction

Recent studies have indicated that morphological awareness makes an important contribution to the quality of reading (Ben- Dror, Bentin & Frost, 1995; Casalis & Louis-Alexandra, 2000; Leikin & Even Zur, 2006). A reader's ability to reflect upon the meaning of morphemes and their ability to parse and manipulate them is termed 'morphological awareness'. It contributes to reading ability over and above the contribution of phonological awareness. (Schiff & Raveh, 2007).

In Ben- Dror and Frosts' (1995) research, it appeared that children with developmental dyslexia displayed morphological weakness in spoken language and its comprehension. Subjects failed morphological assignments, which negatively affected their reading. A similar study by Elbro and Arnbak (1996) provided similar results among dyslexics compared to regular readers in tasks identifying words, and the authors emphasised that morphological awareness is significantly linked to a reader's ability to identify words. These results have been reinforced in many studies examining the morphological effect of the letter identification and production process on successful reading acquisition. (e.g. Abu Rabia & Saliba, 2008; Abu Rabia & Abu-Rahmoun, 2012; Levin, Ravid & Rapaport,1999; McBride-Chang, Shu, Zhou,Wat &Wagner, 2003; Senechal, 2000; Taha & Saiegh- Haddad, 2016).

Studies in the field have demonstrated that regular pupils (without dyslexia) develop sound morphological abilities and awareness of word structures according to their age range, and even understand and develop the morphological links between words, in contrast to those with dyslexia (young and adult) who find it difficult to understand morphological relationships and carry out morphological manipulations in morphological tasks

(Abu-Rabia, 2007; Abu-Rabia & Awwad, 2004; Bryant, Nunes & Bindman, 2000; Carlisle & Feldman, 1995; Kaminsky, Eviatar & Norman, 2002; McBride-Chang et al., 2003; Shankweiler et al., 1995).

Sound morphological awareness positively affects and helps the reading process, since it helps readers to have the ability to process words morphologically and store them using their morphological structure in their mental lexicon, which affects the process of identifying new words efficiently through morphological analogies with similar words stored in their lexicon (Abu Rabia & Wattad, submitted; Abu Rabia & Taha, 2004; Abu Rabia & Awwad, 2004; Beringer et al., 2010; Deacon & Kirby, 2004; Elbro & Arnbak, 1996; Ravid & Schiff, 2006; Roman et al, 2009; Sénéchal et al., 2006).

The Root (الـ جذر)

The root is the formative and semantic nucleus of a word in Arabic and Hebrew. For example the groups of words كاتَب (ka:taba, corresponded with), مَكْتو ب (muka:tabt(un), correspondence) are a 'morphological family' (Berman, 1987) because the words in this family share the same root, , ك تب (k-t-b), and their meaning is linked to writing. In standard Arabic, there are more than 6000 different roots (Boudelaa & Marslen-Wilson, 2011).

There are two types of roots in Arabic (Holes, 1995; Wright, 1995). The first type is strong roots, such as ق رب (q-r-b; closeness), ك تم (k-t-m; hidden) and خ تم (x-t-m; end), which are so called because of their ethnographic and phonological transparency, since their three consonants are expressed methodically in any derivation or declension in any surface structure. The second type of roots in Arabic are weak roots in which one phoneme glides: و/w or ي /y as one of their consonant components. For example, ن و م (n-w-m; sleep), وحد (w-h-d, unity) (Awwad, 2013).

Roots have three elements: semantic, phonologic and orthographic. In the semantic sense, the root is the main content topic of a word and connects words belonging to the same word family. Words can share the same root letters and at the same time have two or more different meanings.

In the phonologic sense, the same three or four root consonants appear in words from the same root, and are linked phonologically. The phonologic unity of a root is breached in cases where roots are likely to have, or cases in which there is, assimilation of root consonants to one of the pattern consonants that appear afterwards. In the orthographic sense, writing root letters does not change despite phonological changes that occur in root consonants, and so there is a perception that roots are linked to their various aspects: to the type of root – whether it is strong or weak; to phonological changes in root consonants; and to transparency levels in the semantic connection between words. Orthography, in fact, plays a crucial role in representing a root because of the consistency and uniformity of letters (Ravid & Bar-on, 2005).

The Morphological Role in Decoding Words among Dyslexic Readers(DR) and Normal Readers (NR)

Current studies show that DR have both a phonological flaw and greater language processing difficulties, particularly at the morphological processing level. Studies refer to normal developmental ability to indicate, or react to, morpheme meanings and decompose and manipulate these morphemes as morphological awareness. This contributes more to reading and pronunciation ability than phonological awareness (Carlisle, 1995; Carlisle & Nonanbhoy, 1993; Hauerwas & Walker, 2003; Mahony, Singson, & Mann, 2000).

Several studies suggest that DR are distinctly delayed in grammatical skills relative to NR (Carlisle, 1987; Siegel & Rayan, 1984; Tyler & Nagy, 1990). Some researchers have studied morphological awareness development and its connection to reading acquisition. There is a positive correlation between morphological awareness and reading achievement levels in several languages (Author,2001,2007; Author & others ,2003, 2004, 2012; Ben-Dror, Bentin, & Frost, 1995; Joanisse et al., 2000).

Investigating the effect of morphological structure on automatic word recognition has been made possible via the priming paradigm and the cross-modal priming. In pairs of words that include the prime and the target, participants are instructed to decide whether the target is a word of the language. The relationship between the prime and target depends on the goals of the study. In the case of using cross-modal priming, the prime and target are distinct perceptual events, with a visual target presented immediately at the offset of an auditory prime (Boudelaa, 2014). Using the priming paradigm in studies on the morphological structures in Hebrew and Arabic

revealed that exposure to the morphemes (root and patterns) facilitates the identification of words derived from that root (Boudelaa,2014,Deutsch et al., 1998; Frost et al., 1997).

Rueckl and Galantucci (2005) examined the locus of morphological priming effects based on studies of repetition priming. It assumes that morphological effects arise from the central mental lexicon that is organised morphologically and contains morphemic entries and/or connections between morphologically related words. Rueckl and Galantucci stressed that morphological priming, like repetition priming, may include several components. They found strong effects of the same-modality morphological priming, and they hold that the morphological priming includes a modality-specific component in addition to the modality-independent one. Their findings also show that response times to targets in the two processing components operate in a cascaded manner, with the modality-specific morphological processes exerting their influence earlier than the modality-independent processes.

A similar study conducted in Hebrew by Raveh and Shiff (2008) investigated the quality of implicit morphological knowledge in adult Hebrew readers with developmental dyslexia. An attempt was made in this study to distinguish between these alternative interpretations by contrasting morphological priming effects in the visual and auditory modalities. Only the students with phonological dyslexia, who exhibited relatively good performance in the orthographic judgment task, exhibited repetition priming but not morphological priming. Strong repetition and morphological priming effects were found for participants with dyslexia when the stimuli were auditory.

Current studies also show that root mediation among young Arab DR leads to improved reading (Ravid, 2001; Ravid & Farah, 1999; Ravid & Schiff, 2006; Schiff & Ravid, 2004; Taha & Saiegh-Hadad, 2016). Similar findings emerged in studies of Hebrew (Ravid & Schiff, 2006; Schiff & Ravid, 2004).

The Current Study

Despite indications of morphological knowledge absences among dyslexics, studies have shown that they employ morphological analyses as a helping strategy in the reading process to overcome the difficulty decoding orthographic code. Nonetheless, there have not been enough studies examining how the mental lexicon is arranged among Arabic-speaking dyslexics of various ages or their strategies for deciphering words. No studies exist regarding whether these readers build their mental lexicon similarly to NR but at a slower pace, meaning, building with development and improved performance and dependent on their reading level, or whether their lexicon is constructed differently.

Do the verb roots of words constitute entities with a role in arranging the mental lexicon among NR and DR at different ages, and do these entities serve different readers when decoding words to the same extent and build their lexicon in the same way?

In the current study, we attempt to answer these questions and to clarify the real locus of the root verb units, and their role in arranging and building the mental lexicon reading of normal and dyslexic pupils of various ages. We hypothesised that the way complex words are represented morphologically and are accessed is similar among Arabic DR and NR. And dyslexics build a mental lexicon more slowly, but the lexicon itself is similar to that of NR and is built as a child develops. Our study was performed after reviewing the studies conducted in this field. It was designed by considering the recommendations for future studies of these prior studies.

Method

Participants

The research sample consisted of three age groups, each with 90 Arab pupils from different Haifa region schools, all native Arabic speakers. The first group included 30 NR in 6th grade, 30 DR in 6th grade, and 30 students with a comparative reading age of normal 4th-grade readers.

The second level included 30 NR in 8th grade, 30 DR in 8th grade, and 30 students with a comparative reading age of normal 7th graders. The third level included 30 NR in 10th grade; 29 DR 10th graders; and 32 students with a comparative reading age of normal 9th graders.

Research Tools

We used a computer to manage lists of words for experiments. Time was measured using DMDX – Damster Display System software, developed by Forster at the University of Arizona (Forster & Davis, 1984).

The experiments were carried out using masked priming and cross-modal immediate repetition task techniques developed by Forster and Davis (1984). Priming occurs when processing words is facilitated as a result of a preliminary stimulus. The rationale is that if lexical representation of words reflects their morphological structure, and decoding them first requires decoding those structures, then mental representations of words with identical morphemes and arousing representation of the priming automatically stimulate TW representation (Forster, 1999).

The masked priming technique is also advantageous in being very sensitive to excessive overlapping between word forms, and it is therefore better suited to investigating effects of morphological connections at the form level than the semantic or conceptual levels.

The Experiments

Priming with roots – visual lexical decisions

The experiment goal was to examine the lexical status of root morphemes and their role in lexical access. We sought to examine whether early exposure to roots could facilitate or speed up the lexical decision regarding TWs derived from that root.

The related condition

This condition constituted the research goal that the PW was a root, with the TW derived from this root. For example: root was صَدَق)) [s-d-k] and verb تَصادَقَ (became friends).

Priming using roots – auditory lexical decisions

This experiment was identical to the first experiment, except the stimuli were auditory. Participants had to decide whether the word they heard exists in the language.

Results

Statistical Analysis

We used a mixed linear model to examine the research hypotheses. This model tests two experimental measures (success percentage [SP] and reading time [RT]), including group (1= NR, 2= DR, 3= comparative reading age [CR]) and experimental conditions, E1= priming with roots – visual lexical decisions; E2= priming using roots – auditory lexical decisions) as fixed effects and class as a random effect. We wanted to draw conclusions on participants of different ages. Furthermore, we assumed that 6th graders have a different starting point from 8th or 10th graders in the effect of the dependent variable, assuming all other explanatory variables are the same. The interactions between the different effects in the model were also calculated.

The mean response time was calculated on the basis of correct reaction data. When participants made mistakes in their lexical decision or did not answer at all, the RT calculations were removed from the results analysis, as were words whose RT was over 5000 milliseconds. A similar calculation was made for the SP of each subject in each condition.

Experiments 1 and 2

In E1 and E2, the lexical status of verb root morphemes in lexical access was tested. The goal of E1 was to examine whether a PW facilitates lexical decisions regarding a TW when both share the same root. The goal of

E2 was to neutralise dyslexics' failures deriving from visual presentation in order to understand whether failures depend on morphological flaws during the lexical processing stage (a stage that is a process of model morphological representation) or whether they are derived from flaws in the initial processing stage.

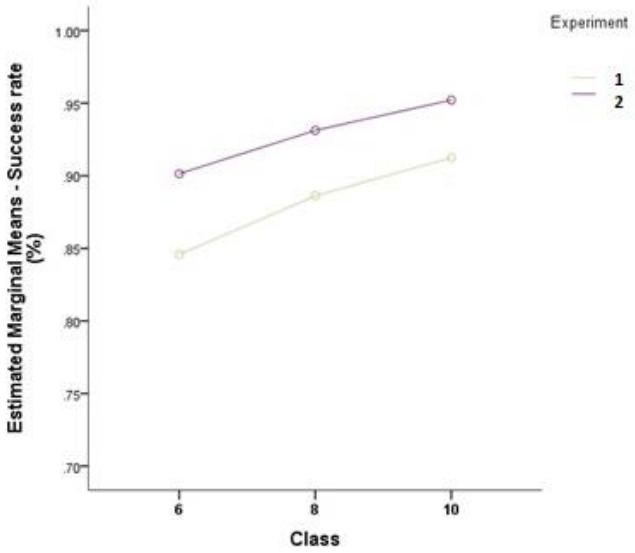

Figure 1

Figure 1 shows that the interaction between the experimental condition and the different age groups. This finding highlights that roots constitute lexical entities and play a significant role in organising the mental lexicon among NR and DR at different ages.

The auditory-morpho priming effect in the root test was stronger than the visual effect among all participants, and it contributed to accelerating lexical decision and answer accuracy (SP). The auditory-morpho priming effect contributed more to accelerate lexical decisions among all groups; however, it did not increase the accuracy of the answers, As such, our hypotheses (the auditory morphological priming effect will be stronger among dyslexics than a visual effect, and the auditory or visual morphological priming effect will be stronger among dyslexics and younger readers than more skilled readers) were confirmed.

In the root words test, DG performances were improved from one level to the next in SP conditions but not RT conditions, indicating that roots contributed to participants' accuracy, but did not enhance their lexical decisions. Lexical decisions among dyslexics were faster in all groups; therefore, it is only logical that they showed no significant differences regarding response time when moving from one age level to another. The two control groups demonstrated improved linear performance in conditions when moving from one level to another. It appears that the root, in contrast to the pattern, enhanced lexical decisions and improved performance among all participants.

Discussion

The current findings showed how morpheme units are stored, arranged, and used, in verb systems — word roots— enabling us to reach conclusions regarding the development of the mental lexicon in Arabic. This process is apparently linked to reading levels and experience. The current research findings indicate that word roots are lexical entities with a role in organising the mental lexicon of all research groups at all age levels. Apparently, employing RMs begins in 4th grade and strengthens with age.

These findings are explained in Boudelaa's (2014) model and are part of the model of word representation in Hebrew speakers' mental lexicon, developed by Frost et al. (2000), in which the mental lexicon is comprised of two levels of representation. Whole lexical units (words) are represented at one level, and sublexical units (root morphemes) at a deeper level. Both levels are interconnected, and one can trace a word through direct access on an ethnographic or phonological basis, or by morphological decomposition during which a root is found. These

processes are likely to be simultaneous, and the word is deciphered using the faster of the two, which is dependent on the word's frequency level in the language (Deutsch et al., 1998; Frost et al., 1997, 2000).

With this model, all words derived from the same root are arranged in the mental lexicon around the RM, which constitutes their common representation (Deutsch et al., 1998). Our findings indicate that among the different groups, especially the two control groups, it seems Arabic verbs derived from the same root are connected by this morphological unit. Therefore, it appears that the Arabic verb system's lexical structure is similar to that of Hebrew, and that the Arabic verb lexicon also consists of two representation levels: whole lexical units, which are high-frequency words, meaning less frequent morphological decomposition (Boudelaa, 2014) and no need for decomposition due to their familiarity, because readers' written units are more developed and every word becomes one written unit; and, at a deeper level, sublexical units (root morphemes), enabling morphological decomposition of low-frequency words.

Conclusion

The conclusion regarding the importance of morphological processing and awareness also (specially- about root morphemes) supports the hypotheses of Tsesmeli and Seymour (2006), who assumed that sound morphological awareness and meta-morphological ability allow one to reach conclusions regarding morphological relations among words, enabling accurate spelling, especially for words derived from others. Tsesmeli and Seymour found that among dyslexics, for whom spelling processes are difficult, a lack of morphological awareness constitutes a central cause for observed absence of spelling skills.

This finding is congruent with and supports the assumption of Rueckl and Galantuccci (2005) and the findings of Shiff and Raveh (2008). As previously discussed, these deficits are explained by the problem dyslexics have in the early process of identifying written words and a lack of ability to automatically extract visual and orthographic features from the printed word, causing the limitation in their learning ability.

Recommendations

In the current research, we did not examine the morphological qualification of dyslexics whose impairments are categorised into different sub-groups of dyslexia, as did Joanisse et al. (2000). We chose the dyslexics in our study according to measurements of reading texts and isolated words, but did not sort them into types of reading impairments and characteristics. The selected group was possibly heterogenic in terms of reading impairment and its traits; therefore, the organisation of the mental lexicon and how morphological structures are represented may be different in every sub-group. Thus, it is important in future research to consider characteristics and various types of impairments, as well as to sort a group of dyslexics into sub-groups to achieve more accurate results.

Another idea is classifying presented words according to frequency (high/low), because some researchers (Bybee, 1995; Katz et al., 1991) have argued that a word's frequency factor dictates lexical storage rather than its morphological complexity. Therefore, morphological decomposition is necessary only when encountering a new word, derived or conjugated, or a low-frequency word. Readers must then employ morphological knowledge to understand the meaning. More frequent words have a greater chance of storage in their whole form, and this is also supported by Boudelaa's OMD model (2014). It is therefore desirable that future studies classify word lists by frequency and control this demarcation during experiments.

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