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### Spelling affix letters in Hebrew: a psycholinguistic outlook

Hebrew-speaking spellers have to contend with a morpho-phonological system which, though originating millennia ago, still impacts on current processes of language acquisition, as well as on the development of linguistic literacy. The focus of this study is the interface of Hebrew phonology, morphology and orthography with cognitive factors of developing abilities of pattern detection and generalization, on the one hand, and linguistic factors of transparency, frequency, and prevalence, on the other.

Spelling Hebrew involves knowledge in three main domains – phonology, morphology, and orthography. Their mapping, however, is not transparent. The history of Hebrew has left its marks in its current orthography in the form of phonology-orthography mismatches. This is because, while Hebrew phonology has undergone tremendous changes before and after its revival as Modern Israeli Hebrew, its orthographic system has come through the generations mostly unscathed. Modern Hebrew orthography thus reflects defunct phonological distinctions due to the loss of the classes of emphatics, stop / spirant symmetry, gutturals/pharyngeals, and the historical glide *w*. For example, the current Hebrew consonant *v* derives from two historical sources – the glide *w* (spelled ו), and the spirantized form of *b* (spelled ב, exactly like the stop *b*). Thus, former phonological distinctions are translated into the form of two distinct graphemes for a single phonemic segment (Ravid, 2005). Hebrew spellers are challenged by five main such phonology / orthography mismatches: *v* spelled by both ב and ו, *k* spelled by both ק and כ, *x* spelled by both נ and כ, and *t* by both ת and ט. In addition, the three letters ע, ה, א (historical guttural / pharyngeal) all stand for the glottal stop ʔ, often interchangeable with zero. These constitute a major source of spelling errors in Hebrew.

At the same time, these same neutralizations of historical phonological distinctions are retained in Hebrew morphology. The letters of each pair are

constrained by their morphological roles as either root or affix letters. Spelling affix letters is generally less challenging than root letters, as most affixes have lower type and higher token frequencies, coupled with higher morpho-orthographic transparency, than roots (Ravid, 2001). For example, as ט is only a root letter, it does not compete with ת in marking the feminine plural suffix in *ktuvot* כתובות 'written, FmPl'. Thus we can assume that identifying the morphological role of the homophonous letter as an affix versus root letter should facilitate correct spelling. An important factor here is the morphology / orthographic interface, as root (or stem) letters typically congregate in the center of the written Hebrew word, whereas affixes letters (inflectional, derivational, and clitic) take peripheral positions in the outer envelope of the word, as in the example of **ו** **ב** **מ** **כ** **ת** **ב** **י** **ם** 'and-in-the-letter-s', where the bolded letters at both sides of the root **כתב** 'write' represent function roles of conjunction, preposition, pattern prefix and plural suffix, respectively from right to left. The small number of affixes (low type frequency), their ubiquity in spoken and written Hebrew (high token frequency), and their distinct peripheral positions all serve as reliable morphological pointers to affix morphology, and therefore to correct spelling. We should thus expect the growth of morphological knowledge coupled with cognitive, linguistic and literacy development to override spelling homophony in native-speaking Hebrew spellers (Ravid, 2012).

However, not all affixes are easy to identify in their non-root roles, as the boundaries between root and affix sites might be blurred, e.g., in words with irregular roots such as **תועלת** 'benefit', where the root (bolded) is not entirely consonantal and the first ת might be interpreted as a root letter. There are other factors that might stand in the way of a successful mapping of the morphology-phonology-orthography link, which promotes correct spelling. Frequency and coherence (=consistency) of letter, word and category can hinder or facilitate affix identification and spelling, especially in specific sites. Thus, for example, *v* is more likely to be linked to ו as an affix (the conjunction *ve-*) at the beginning of the word, and less to ו at the end of a word, where it has few roles, e.g., representing an allomorph of the 3<sup>rd</sup> person possessive in *-iv*.

The current study examines the full array of Hebrew affixes and all of their functions in psycholinguistic perspective, focusing on those affix letters where a confluence of factors such as those described above masks morphological cues. Study participants were 83 monolingual Hebrew-speaking students in four grade levels – 2<sup>nd</sup>, 4<sup>th</sup>, 7<sup>th</sup> and 10<sup>th</sup> grades. The research instrument was a spelling task of 244 words containing affix letters in 57 morphological categories, presented in the context of short sentences to assure clarity of meaning. Students were asked to spell only the target words. Affix letters were analyzed on the basis of five criteria taking into account the following notions: (1) Size of the morphological category (type frequency); (2) transparency of morpho-orthographic sites, i.e., the degree to which it is possible to make a distinction between the central root morphemes and the affixal periphery. For example, in **תרדמה** ‘slumber’ it is easy to perceive the affix letters (signifying pattern prefix and suffix), whereas in **תועלת** ‘benefit’ above it is difficult; (3) morpho-orthographic prevalence, that is, the frequency of the letter in its morphological and orthographic roles – for example, **ת** is not only found in many orthographic sites, but also has many function roles; (4) morphological “enemies”, i.e., competitors in the same or different roles, such as **ה** and **'** as tense prefixes; (5) and phonological-orthographic consistency, as in the prevalent link between a final *-a* being universally spelled by **ה**.

Findings indicate that correct spelling increased across grade levels, and in addition, a hierarchy emerged in interaction with grade level regarding the five criteria: Younger spellers were mostly assisted by morpho-orthographic sites, morphological category frequency, and phonological consistency / transparency. In contrast, correct spelling in higher grade levels was more affected by the factor of morpho-orthographic prevalence. These findings indicate that knowledge of how morphological roles are deployed in the orthography emerges as the most significant factor that affects learning to spell affix letters in Hebrew.

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