

Typological effects on the development of written morphology: A crosslinguistic study of Hebrew and Dutch

Steven Gillis and Dorit Ravid
University of Antwerp, Tel Aviv University

Morphology is expressed in both spoken and written language modalities. Orthographic systems reflect to a certain extent morphological regularities of their spoken languages. For example, the Hebrew root *k-t-b* 'write' undergoes phonological changes (compare spoken *mixtav* 'letter', *ktuba* 'marriage contract'), but the written root is spelled consistently as K-T-B (compare written forms MKTB 'letter', KTBH 'marriage contract'). This paper is concerned with the way written morphological consistencies are learnt in two languages with highly divergent morphologies: Hebrew and Dutch.

The development of written morphological representations in schoolchildren is treated in this paper from three perspectives. One focus is a crosslinguistic examination of a psycholinguistic model which accounts for the way children learn to integrate and map linguistic information onto orthographic segments. Alphabetic orthographies are based on the grapho-phonemic principle, requiring the child to plot out and map grapheme-phoneme pairs. Most orthographies are not entirely "shallow", that is, they do not represent phonological information fully and accurately. Homophonous graphemes, which provide alternative spellings for the same phoneme (e.g., Hebrew VET and VAV spellings for [v]) frequently occur in many orthographies. However, orthographies may provide their learners with morphological and morpho-phonological means for recovering the grapho-phonemic link in cases of opacity. For example, the two Dutch words *arend* 'eagle' and *agent* 'officer' share a final [t] in speech due to final devoicing, however written Dutch retains the *t/d* distinction in the spelling. Though these cues are sometimes quite complex to formulate explicitly, they may be assumed to exist in the linguistic cognition of mature spellers and eventually have to be accessed by children.

A second focal point relates to the impact of typological features on this development. There is a growing body of evidence to the effect that children are attuned to typological underpinnings of their language from early on and employ appropriate strategies in linguistic problem-solving. The two languages under consideration here differ greatly in their morphological typologies. Hebrew is a Semitic language with a highly synthetic morphology, while Dutch, a Germanic language, has a sparse morphology. Given that, it is reasonable to assume that Israeli and Belgian children will approach differently morphological information encoded in their respective orthographic systems.

A third and final perspective relates to two different models of learning and representation of morphological knowledge. A *dual-route model* assumes the existence of two distinct processing systems to handle the two facets of morphology: abstract, symbolic rule and lexical memorization. A *single-route model* denies a split in processing mechanisms, and proposes to handle morphology by associative memory alone. We will attempt to explain the results of this study in terms of both models and compare their explanatory power.

The phenomenon investigated in this paper is learning to overcome homophonous spelling. For different reasons, certain phonological distinctions in both Dutch and Hebrew are neutralized, yet these segments are mapped onto distinct graphemes, e.g., [t] spelled by <d> or <t> in Dutch, [t] spelled by TAF or TET in

Hebrew. This opaque phonology-to-orthography mapping constitutes an obstacle to the acquisition of correct, or conventional, spelling. The study examines the effect of morphological and morpho-phonological cues on Hebrew-speaking and Dutch-speaking gradeschoolers learning to spell homophonous forms.

The research design of this study consisted of spelling tests. The target items with homophonous segments differing in spelling, were divided into four groups of conditions which differ in the degree of recoverability of the spellings of the target items. “Recoverability” indicates the existence of conversion procedures whereby the correct grapho-phonemic mapping is achieved. For example, Dutch verbs in present tense and in past participle ending with surface [t] due to final devoicing: *betover* ‘bewitch, present tense’ / *betoverd* ‘bewitch, past participle’, spelled with <t> and <d> respectively. The difference in the spelling can be recovered either through morphology, that is present tense spelled with <t>, past tense spelled with <d>, or through morphophonology, by converting past participle forms to adjective or to simple past, thus recovering surface [d].

The four test conditions are summed in the following scheme, from most motivated (condition I), to least motivated or most arbitrary (condition IV).

Condition	Morphological Function	Morpho-phonological Recoverability
I	+	+
II	-	+
III	+	-
IV	-	-

We predicted that children learning Dutch and Hebrew would respect the arbitrariness scale and show the same learning profile: the more motivated the relationship between phonology, morphology and orthography, the fewer errors.

Results. For Hebrew, our predictions are confirmed. The less arbitrary or more motivated conditions in Hebrew are learnt earlier than the more arbitrary or less motivated conditions. For Dutch, our predictions are not confirmed. The more arbitrary or less motivated conditions in Dutch are learnt earlier than the less arbitrary or more motivated conditions. Regarding morphology, in Hebrew, the morphologically recoverable items have a higher score than the non-recoverable ones. In Dutch, the morphologically recoverable condition shows no learning before 6th grade, while the non-recoverable items are very easy. Regarding morpho-phonology, our results show that in Hebrew, morpho-phonologically recoverable items had a consistently higher score than the non-recoverable ones. In Dutch, the two types of target items had identical learning curves. Morpho-phonological cues thus facilitate learning to spell in Hebrew-speaking children but have no effect on the development of Dutch-speaking children. Thus morphological and morpho-phonological cues facilitate learning to spell in Hebrew-speaking children and either hinder learning or are learning-neutral in Dutch-speaking children. A possible explanation derives from language typology. Hebrew-speaking children grow in a highly synthetic language with diverse semantic categories expressed by a rich morpho-phonology. As a result, Hebrew spellers look for morphological and morpho-phonological cues from their initial encounter with its orthography. But morphological cues are not good cue providers for Dutch-speaking gradeschoolers, who are attuned to a morphologically sparse language and to looking for syntactic cues.

We examined in depth a specific morphological distinction in both languages: homophonous letters with a stem or root function (e.g., [t] in Hebrew *masot* ‘oar’, root š-w-t, spelled with TET) vs. an affix function (e.g. [t] as part of suffix *-ot* in Hebrew *kasot* ‘hard,Pl,Fm’, spelled with TAF). From a grapho-phonemic point of view, our prediction was a null hypothesis for both languages, with stem/root and affix having the same degree of difficulty. From a morphological viewpoint, our predictions differed for a rule-type model and a lexical storage model. Rule-type behavior would assume spelling affixes to be easier for both languages, since in both Hebrew and Dutch affix letters map morpho-syntactic information uniquely and transparently. Stems/roots, in contrast, should be harder to spell in this model in both Hebrew and Dutch since their spelling-phonology mapping is arbitrary. A lexical storage model would result in different predictions for Dutch and Hebrew. For Dutch, it would assume easier stem/roots since each has a unique phonological representation (either t or d) in the mental lexicon, while affixes should be harder in this model since both representations with t and d exist in the lexicon and compete with each other. For Hebrew, the lexical model would predict easier affixes since the phonology-orthography link is always the same, while roots are learnt subject to frequency of root, of word-family, of specific words in which the root occurs. Our results show that for Hebrew, affixes are easier to spell than roots. In Dutch, stems are easier to spell than affixes. Thus the two models can explain the Hebrew results, but only the lexical-access model can explain the Dutch results.

We also examined in depth a specific morpho-phonological cue in both languages: markedness. For both Hebrew and Dutch, our tests contained default items which could be spelled “phonetically” (e.g., [t] - <t> in Dutch, [x] - XAF in Hebrew), and marked items which deviated from the phonetic spelling (Dutch [t] - <d>, Hebrew guttural [x] - HET). We found contrasting results for the two languages: In Hebrew, marked items are easier to spell, while in Dutch default items are easier to spell. A possible explanation relates to the saliency of these structures. In Dutch, both types of items are phonologically neutral, and so the direct phoneme-grapheme route is selected. However, in Hebrew, the marked items are also salient, since they attract lower vowels and result in different CV templates than the unmarked items whose phonological templates conform to the default case.

Conclusions. Orthographic knowledge of alphabetical systems is linguistic in nature. Spelling has long been considered external to the domain of linguistic and psycholinguistic inquiry. It is only in the last two decades that linguists and psychologists have seriously considered writing systems as representational systems in their own right rather than mere reflections of speech. Orthographic systems encode representations of linguistic notions such as “phoneme”, “morpheme”, “word”, etc., and the knowledge that is needed to spell involves linguistic domains of phonology, morphology and syntax. The process of learning to think about a writing system goes hand in hand with learning to think about spoken language. Therefore, language typology plays an important role in the way children approach their language. A phonologically “deep” and morphologically rich and complex spelling system is not necessarily harder to acquire than a relatively simple one: rather, it is the underpinnings provided by the language structure that determine learning patterns in spelling development. Finally, this study sheds some light on questions of lexical organization and access. It shows that saliency and transparency of phonological representations and unique links with target orthographic representations play an important role in learning to spell.