

# Language-Specific Effects on the Development of Written Morphology

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## 1.0 Introduction

This paper discusses the morphology of children's written language from a developmental perspective, examining the acquisition of written morphology in gradeschool children from the beginning of formal literacy education to the end of gradeschool. We examine how children learning to spell Hebrew and Dutch – two typologically very different languages – approach problems in mapping phonology and morphology onto written graphemes in their respective languages.

While morphology constitutes an important part of the spoken modality of many languages, it is also reflected in the written modality of languages with alphabetic orthographies, which often express morphological regularities in their units. For example, the consonantal root, which constitutes the lexical core of the word in Hebrew (Berman, 1987; Holes, 1995) takes slightly different forms in the Hebrew words *mixtav* 'letter', *ktav* 'writing', and *ktuba* 'marriage contract', due to stop / spirant alternation, but its written form remains consistent in MKTB, KTB, and KTWBH<sup>1</sup> respectively, despite these phonological alternations (Ravid, in press a).

The aim of this study is to find out how such morphological consistencies in Hebrew and Dutch are learnt by Israeli and Belgian gradeschoolers, using an experimental design which looks into the acquisition of spelling. We intend to show that the acquisition of spelling is linguistic in nature and interacts with knowledge of spoken morphology.

## 1.1 Ways to overcome phonological neutralization

The central phenomenon focused on in this paper is learning to overcome homophonous spelling resulting from neutralized phonological distinctions which are retained in the spelling system.

Alphabetic orthographies are based on the grapho-phonemic principle, and thus learning consists of linking phonemes to graphemes. However, most orthographies are not entirely shallow: they do not reflect phonological information fully and accurately. Homophonous graphemes, which provide alternative spellings for the same phoneme, occur in many orthographies. For example, the homophonous Dutch form *verplicht(t)e* ‘required, Adjective / Simple Past’ may be spelled with either a single or a geminate <t> but there is no change in the pronunciation. In the same way, the homophonous Hebrew form *va'ir* ‘and-city / light’ may be spelled with either <W> or <B>. These cases of opacity often result from neutralizations of underlying phonological distinctions in phonetic strings, which are nevertheless retained in the spelling system and are typical sources of spelling errors<sup>2</sup>.

It is possible, of course, to learn the spelling of homophonous words arbitrarily, or to use visually consistence patterns as cues. But as we shall show, morphological and morpho-phonological analysis can also serve as spelling aids. Spelling systems often encode morphological units consistently and children have to learn and use this information in order to spell correctly. For example, the homophonous Dutch word [b palt] ‘determine(d)’ may be spelled with either final <t> or <d>, which are not merely phonological segments but also meaning-carrying elements, signifying present tense (*bepaalt*) or past participle (*bepaald*) forms. In this case, conscious manipulation of the verbal paradigm can directly assist in finding the correct spelling. In Hebrew, the rhyming words *kashot* ‘hard,Pl,Fm’ and *mashot* ‘oar’ are spelled differently and the

spelling carries different morphological significance. In *mashot*, the [t] is part of the root and is spelled with <T>, representing a historically emphatic coronal stop. In *kashot*, the [t] is part of the suffix *-ot* signifying feminine plural, and is spelled with <T>. Being able to analyze Hebrew words into their morphological components, even to a shallow degree, can help recover the difference in spelling.

However, morphological manipulation is not always applicable. For example, in Dutch *arend* ‘eagle’ and *agent* ‘policeman’, the identical final segment [t] serves in both cases as a stem consonant, so a learner cannot be helped by morphology in deciding which to spell with <t> or with <d>. In the same way, the final [x] in Hebrew *dérex* ‘road’ and *kérax* ‘ice’ is spelled differently, but does not carry morphological significance, since these are both root segments. Thus, Hebrew spellers cannot be assisted by morphology to decide on the correct spelling.

Fortunately, alphabetical orthographies may provide their learners with another, morpho-phonological means for recovering the grapho-phonemic link in cases of phonological opacity with distinct spelling. For example, the two Dutch words *arend* ‘eagle’ and *agent* ‘policeman’ share a final [t] in speech due to final devoicing. However written Dutch retains the <t>/<d> distinction in the spelling. This neutralized phonological distinction can be recovered through pluralization to *arenden* and *agenten* respectively, and thus conscious morpho-phonological manipulation of these words can assist in their correct spelling. In the same way, awareness of Hebrew morpho-phonological patterns can assist in the spelling of *dérex* ‘road’ and *kérax* ‘ice’. These words are susceptible to spelling errors since they have the same vocalic pattern *CéCeC*, and they also share a final surface segment *x* which can be spelled as either <K> or <H>. Noting that *kérax* has a lower vowel *a*, making it deviant from the general pattern and thus marked, can help in recovering the correct spelling. This phonological markedness is related to a historical Hebrew distinction between letters representing a spirantized velar fricative (<K>), on the one hand, and a pharyngeal fricative (<H>), on the other. Though

such morpho-phonological cues may be rather complex to formulate explicitly, independent empirical evidence shows they exist in the linguistic cognition of mature spellers and are eventually accessed by children (Ravid, in press b).

Thus Dutch and Hebrew spellers are faced with similar, though by no means identical, problems in learning to spell homophonous words with distinct spelling, and may resort to similar morphological and morpho-phonological strategies in recovering spelling differences. But will they indeed employ similar strategies and follow the same developmental path in learning to spell? Recent cross-linguistic research has demonstrated the influence of language-specific effects on a variety of domains from early speech perception to children's narrative development in different languages (see the summary in Berman & Ravid, in press). We assume that children are attuned to typological underpinnings of their language from early on and employ appropriate strategies in linguistic problem-solving. In this study we trace the impact of morphological typology on children learning Hebrew, a Semitic language with a highly synthetic morphology, and Dutch, a Germanic language with a sparse morphology.

## 2.0 The study

This cross-linguistic study concerns spelling morphological and morpho-phonological strategies in gradeschool children faced with phonological opacity which may lead to spelling errors.

### 2.1 Population and materials

The study population consisted of 192 Israeli and 192 Belgian monolingual Hebrew- and Dutch-speaking schoolchildren with a middle-high socio-economic

background from grades 1-6. They were presented with two spelling tests (one in Hebrew, one in Dutch), containing neutralized phonological segments and asked to spell the target words, which were given in a sentential context to ensure clear and non-ambiguous understanding.

There were four test conditions, each represented by 8 target words. Condition I contained homophonous target segments recoverable through both morphological and morpho-phonological cues. Condition II contained homophonous items with a morpho-phonological (but without a morphological) conversion cue for each language. Condition III contained homophonous items with a morphological (but without a morpho-phonological) conversion cue for each language. Condition IV consisted of homophonous segments with two possible spellings with no recoverability through either morphological or morpho-phonological cues.

## 2.2 Predictions

Following from the background presented above, we expected that given a neutralized phonological distinction, the more motivated the relationship between phonology and orthography, the better the children's performance. 'Motivation' means here that the target segment/grapheme either has a morphological function (e.g., root vs. affix morpheme) or is recoverable through a particular morpho-phonological conversion process that can be applied so as to figure out how to spell the target letters. In this respect we did not expect any major differences between Dutch and Hebrew.

## 3.0 Results

Results are verbally summarized below. For numerical tables and statistical analyses, we refer to Gillis & Ravid (2000).

### 3.1 Written morphology in Hebrew and Dutch

Our predictions were confirmed for Hebrew: all conditions showed a distinct learning pattern. The condition with the most motivation – Condition 1, with both morphological and morpho-phonological cues – was the easiest. It was followed by Condition 3 (morphological cues only) and Condition 2 (morpho-phonological cues only). The most difficult condition was Condition 4, the least motivated condition, in which there is an arbitrary relationship between the spoken and the written form. For Dutch these predictions were not confirmed. The two conditions with no morphological cues - Condition 4 and Condition 2 - were the easiest, with almost ceiling scores from second grade onwards. However for the two morphologically informative conditions Condition 1 and Condition 3, no learning was found until fifth grade.

Judging from these results, it seems easier to learn to spell in Hebrew than in Dutch. Moreover, children learning to spell Hebrew perform better when the target segments have a morphological function, and less well when they do not. Children learning to spell in Dutch show the opposite pattern: when the target segments do not have morphological function, they score better than when segments do have a morphological function.

### 3.2 Different morphological functions in Hebrew and Dutch

We now turn to learning to spell with the assistance of different morphological functions. We looked at the same target segment as part of the root<sup>3</sup> / stem and as part of

the affix. For example, in Dutch the letters <t> and <d> were contrasted as stem letters in the words <arend> ‘eagle’ / <agent> ‘officer’, and as affix letters in <bepaald> ‘determined’ / <bepaalt> ‘determines’. In Hebrew, <T> and <T> were contrasted as root and affix letters. <T> functions as root letter in *ma~~sch~~* ‘oar’, spelled M~~sch~~T, while T functions as an affix letter signifying number and gender in *ka~~sch~~* ‘hard,PL,Fm’, spelled Q~~sch~~T. Presumably, affix letters, whose spelling is more consistent and regular, should be spelled correctly earlier than root or stem letters.

This assumption holds for Hebrew. In Hebrew, affix letters were found to be easier to spell than root letters from first grade onwards. Root letters take longer to learn. In Dutch, the opposite pattern emerged: letters that are part of the stem were found to be easier to spell than when they are part of the affix. Only stem letters showed learning early on, while affix letters stayed more or less at chance level.

### 3.3 Morpho-phonological cues in Hebrew and Dutch

We now turn to morpho-phonological information that could also assist in recovering underlying distinctions and consequently in learning to spell homophonous segments. We examined one particular aspect of recoverability, morpho-phonological markedness, using only roots and stems in Condition 2, so as to isolate recoverability from morphological function. Both the Hebrew and Dutch spelling tests contained marked and unmarked elements. Unmarked segments were those segments for which pronunciation coincided with the spelling; marked segments were those whose pronunciation was neutralized to that of the unmarked segments. For instance, in Dutch [t] can be spelled as either <t> (as in *agent* ‘policeman’) or <d> (as in *arend* ‘eagle’). The marked element <d> deviates from “phonetic spelling” ([t] in *agent* written as <t>, but [t] in *arend* written as <d>) and surfaces in the plural (singular *arend* versus plural *arenden*).

Thus, <t> is the default (spelling follows pronunciation) and <d> is the marked segment, since the spelling does not follow its pronunciation.

In Hebrew, marked elements like <H> in *kérax* 'ice' deviate from the canonical structure *CéCeC* by lowering /e/ to /a/ and creating a non-canonical allomorphic pattern template. Unmarked elements such as <K> in *dérex* 'road' behave regularly and follow the general pattern. Thus, <K> is the default segment, where *dérex* 'road' is spelled <DRK>, while /H/ is the marked segment, where *kérax* 'ice' is spelled <QRH>. Presumably, unmarked items would lead to more success in spelling.

Across the two languages, morpho-phonologically recoverable distinctions indeed led to better results than non-recoverable ones. However, Israeli and Belgian gradeschoolers made different use of marked and unmarked segments. In Dutch, unmarked segments were easier. They were spelled correctly from the very beginning, while marked ones showed a learning curve and intersected with unmarked segments in third grade. In Hebrew, marked segments were easier. Learning proceeded for both segment types with age and schooling, however marked segments reached almost top scores early on, while unmarked ones took a long time. Our results thus showed a crossover effect, where in Dutch unmarked segments were easier than marked ones, while in Hebrew, marked segments were easier than unmarked ones.

#### 4. Discussion and conclusions

This study tested Hebrew- and Dutch-speaking gradeschoolers (grades 1-6) on spelling words with homophonous segments with and without morphological and morpho-phonological cues which they could use to detect the correct spelling.

One of the clear findings of this study is that spelling development is not a mere technical skill of phoneme to grapheme conversion. There is more to it than simply

mirroring speech. Orthographic knowledge is linguistic in nature and it involves integrating information from a number of linguistic dimensions – phonology, morpho-phonology and morphology. This is because orthographic systems encode linguistic concepts such as phonemes, morphemes, words, and sentences, and children have to represent these in their oral language knowledge, as well as learn how these concepts are represented in the specific orthography they are learning.

Another major finding of this study relates to the impact of typology and the interface of spoken and written language. As has been pointed out by Olson (1994), there is a reciprocal relationship between spoken and written language systems. The type of spoken system children are exposed to from birth affects the way they think about their orthography – and has been shown in other studies, written language perception shapes thinking about spoken language. Learning to think about spoken language thus shapes and is shaped by thinking about written language. Our study is one more contribution to the growing number of studies that have investigated the impact of typology on language acquisition. The idea is that children who are learning to spell do not approach the orthography they are learning “tabula rasa”. Rather, their linguistic problem-solving is shaped by the spoken language system they have been learning.

This attention to morphological information does not relate only to form-meaning relations, but also to morpho-phonology. Morpho-phonological information is meaningful to children learning to spell in Hebrew, who are used to dealing with allomorphic variations and to making generalizations across forms that differ in phonological shape. For children learning to spell in Dutch, this information, as we have shown, is not very significant. We have also shown in this study that “easy” and “hard” in the acquisition of written morphology are not straightforward terms. Dutch is a language with a simplex morphology and with a relatively shallow spelling system, which is easy to teach at school. Nevertheless, our Belgian gradeschoolers did not on the whole do as

well as the Israeli gradeschoolers who are learning a deep non-vowelled orthography in a language which is morphologically complex, where a variety of semantic notions are mapped onto a large array of morpho-phonological allomorphic variations.

Clearly, children are guided by the interface of strategies appropriate to their spoken language systems as well as by universal factors in learning to spell. The problem of markedness is a case in point. A marked segment is deviant in both cases. However, Dutch-speaking children take an essentially grapho-phonemic approach to the problem, and start out by seeking a one-to-one mapping between what they hear and what they write, homing in on the unmarked segment. Hebrew-speaking children, in contrast, do not assume only a grapho-phonemic link, but are also sensitive to the deviant, salient information produced by the marked segment. The underpinnings of the specific language structure thus determine learning patterns in spelling development.

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## Notes

<sup>1</sup> To facilitate comprehension, we use Latin capitals to represent Hebrew letters.

<sup>2</sup> In this study we focus on the standard non-vowelled version of Hebrew orthography, in which consonants are represented fully, but vowels are represented only partially and ambiguously.

<sup>3</sup> Hebrew roots consist only of consonants. Stems contain vowels.