

# Typological Differentiation in the Development of Orthographic Systems: Evidence from Hebrew and Dutch

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## 1. Introduction

The study discussed in this paper examines how children acquiring Hebrew and Dutch learn their respective orthographies, and in what ways their acquisition is constrained by the different typologies of these two languages. In recent years linguists and psychologists have shown growing interest in the linguistic nature of orthographic systems (Aronoff 1994), in their psycholinguistic representation in adults (Derwing 1992) and in their development in learning to read and write (Bryant & Goswami 1987, Treiman 1993). In this paper we focus on the role of phonological and morphological information in children's developing orthographic perception in two languages with differing linguistic typologies: Hebrew and Dutch.

More specifically, our aim is to find out how children acquiring Hebrew - a Semitic language with a rich synthetic morphology and a "deep" or opaque orthography, and Dutch - a Germanic language with a sparse morphology and a "shallow" or transparent orthography - use morphological and morpho-phonological cues in learning to spell homophonous segments.

The logic of the study is as follows: in both languages there are underlying phonological distinctions (e.g., voiced vs. voiceless), which are phonetically neutralized (e.g., devoicing in auslaut), yet the segments are mapped onto distinct graphemes. 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. Similarly, Hebrew *tarim* 'you,SgMasc-will-lift' and *ta'im* 'tasty' share an initial [t] due to historical neutralization processes, however written Hebrew makes a distinction between TRYM<sup>1</sup> (spelled with TAF) and T9YM (spelled with TET).

In both languages the underlying phonological distinction is "recoverable" in some cases and not recoverable in others. Recoverability means that there are

morphological and/or morpho-phonological cues for detecting the correct grapho-phonemic mapping.

Finally, the target segments may or may not have a distinct morphological function, i.e. they are part of the root / stem (no distinct function) or they may function as an affix, and hence, have a distinct morphological function.

## 2. The study

The study population consisted of 240 Israeli and 240 Belgian monolingual schoolchildren with a middle-high socio-economic background from grades 1-6. They were presented with two spelling tests containing neutralized phonological segments, which could be recovered using morphological and/or morpho-phonological cues. Subjects were asked to spell the target words which were given in a sentential context to ensure clear and nonambiguous 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. In Dutch, there were pairs of verbs in present tense and in past participle ending with surface [t] due to final devoicing, e.g., *betovert* 'bewitch, present tense' / *betoverd* 'bewitch, past participle', surface form [bətovərt]). The verbs are spelled with <t> and <d> respectively, recoverable either through morphology (tense manipulation) or through morpho-phonology, by converting past participle forms to adjective or to simple past, thus recovering underlying /d/. In Hebrew, there were pairs of words containing the same segment [v] as a function letter vs. a root letter. For example, *ve-red* 'and-get down' ([ve] stands for a function letter 'and' spelled <W>) / *vered* 'rose' ([ve] is a root letter spelled <W>). This homophonous [v] could be recovered either through morphology (affixal [v] is always spelled <W>, whereas root letter [v] is spelled either <B> or <W>); or through morpho-phonology (<W> always represents a spirant, whereas <B> represents an alternating pair of stop and spirant). Condition II contained homophonous items with a morpho-phonological (but not morphological) conversion cue for each language. Condition III contained homophonous items with a morphological (but not 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.

The four conditions of the research design were thus systematically varied according to the following scheme:

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

III	+	-
IV	-	-

Our hypotheses were that the richer the cues in the test condition, the more transparent or less arbitrary it was, and that more transparent and less arbitrary test conditions would lead to more success in spelling homophonous segments. We did not predict differences between the two languages in this respect.

### 3. Results

*Morphological function.* Both spelling tests contained target segments that were part of stems (or roots), as well as segments that were part of affixes. Stems constitute the lexical substance of a word, while affixes have categorical function, indicating inflectional or derivational categorization. Semitic roots are a specific type of stem that consists only of consonants, while stems contain both consonants and vowels. In Dutch, we examined children's ability to spell surface [t] as either <t> or <d> as part of a stem (e.g., *arend* 'eagle' and *agent* 'officer'), and as an affix letter indicating either past or present (e.g., [bəpalt] 'determine(d)'). In Hebrew, we looked at children's ability to spell surface [t] as either <TAF> or <TET> as part of a root (e.g., *mašot* 'oar', root š-w-t, spelled TET) and as part of a plural suffix (e.g., in *kaš-ot* 'hard,Pl,Fm'). This means that in both languages, we analyzed children's spelling of the same grapheme, which was part of the stem/root in some test words and part of an affix in other test words. We hypothesized that for both languages affixes would be easier to spell than stems/roots, since affix spelling is regular and predictable while stem spelling is item dependent.

Figure 1 shows that our hypothesis is confirmed for Hebrew: Affix letters are easier to spell than root letters from Grade 1 onwards, while root letters start at chance level and then learning takes place. For Dutch, the opposite pattern holds: counter to our hypothesis, letters that are part of the stem are far easier to spell than when they are part of the affix. Both stem letters and affix letters start at chance level, but only stem letters show a learning curve from early on, while affix letters stay more or less at chance level.

This analysis of the acquisition of affix and stem/root letters in both target languages brings forth the central role of language typology. Hebrew-speaking children know about roots and affixes in their spoken language from early on (Ravid in press). Therefore, it is natural for them to turn to a morphological

strategy when they are learning to spell. In Hebrew, the difference between affixes and roots is very clear: if a root segment is homophonous, it can have two spellings, and correct orthographic mapping requires a prolonged and diverse exposure to occurrences of the same root in words. But as an affix it has one and only one possible and consistent orthographic mapping. Therefore, this study like others shows that affix spelling is easy for Hebrew learners from grade 1 (Ravid 1999). In Dutch, however, children seem to be making lexical distinctions between words with the same sound, but they are not efficiently marking grammatical distinctions between two forms of the same lexical word with different affixes. This is probably due to the non-morphological strategies of Dutch learners, for whom morphology is not a preferred option early on.

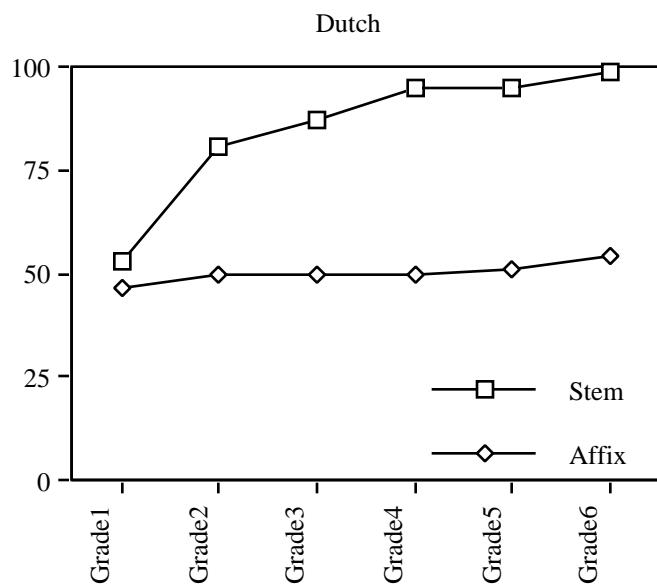
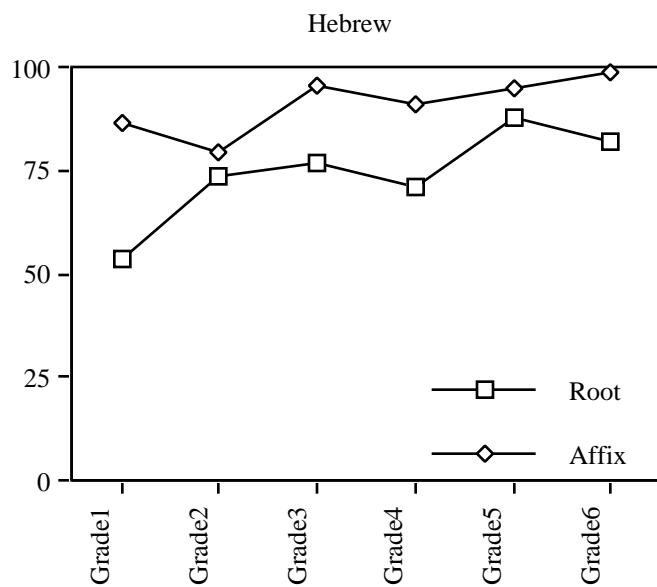


Figure 1: Percentage correct root/stem and affix graphemes in Hebrew and Dutch.

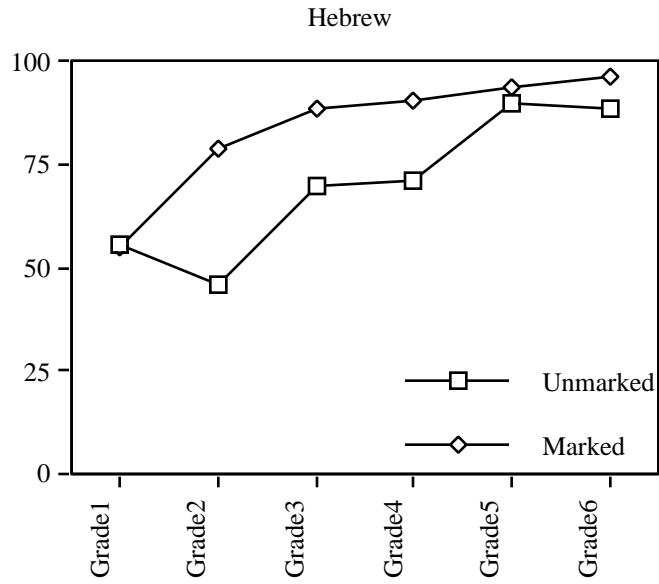
*Markedness.* The second phenomenon compared in detail in this paper is related to morpho-phonological recoverability. In both languages, there are phonologically neutralized segments whose pronunciation is closer to the spelling. We termed these *unmarked* or *default* segments. We termed those homophonous segments whose pronunciation is neutralized to that of the unmarked form *marked* segments. In the Dutch pair [ɑyɛnt] <agent> - [arɛnt] <arend>, the default segment is [t], spelled as <t> in <agent>, while the marked one is [ɛ] resulting from final devoicing and spelled <d> in <arend>. In Hebrew, the unmarked or default alternant of [x] is spelled <KAF> (a spirant form of /k/) (e.g., *deréx* ‘way’ spelled <DRK>), while the marked alternant of [x] is spelled <HET>, a former guttural now neutralized to [x] (e.g., *kérax* ‘ice’ spelled <QRH>). Again, we predicted a similar learning outcome: the more transparency, the more success.

Figure 2 indicates that transparency is not a uniform or self-evident phenomenon. In Dutch, *unmarked* segments are easier to spell than marked ones from Grade 1. In Hebrew, *marked* segments are acquired before unmarked ones. For both segment types, Hebrew learners start at chance level, but learning is fast for marked segments and is slower for default forms which are harder to learn until the end of gradeschool.

Unlike the stem/root vs. affix phenomenon, there is no semantic or grammatical function initially required in learning to spell with morpho-phonological recoverability. The Dutch strategy in this case is initially phonological in nature and does not need to take morphology into account. It seems that young Dutch-speaking spellers start out with a clear hypothesis of a one-to-one mapping of sound onto orthography, but learn to revise this hypothesis soon enough. Hebrew learners start out with no initial hypothesis about their spelling, since all target items are root letters and therefore there is no morphological learning bias. The marked target items in Hebrew are more salient since they are morpho-phonologically different from their background: items with default [x] take on the canonical vocalic pattern (e.g., *CéCeC*), but items with marked [x] have underlying guttural segments which attract lower vowels and there change the canonical form of the vocalic pattern (in this case, *CéCeC* --> *CéCaC*). This results in an attention-getting salient form that is learnt early on.

#### 4. Discussion

A general conclusion of this study points at the important role of linguistic typology in written language acquisition. Language typology determines how good a cue provider morphology is in the development of spelling. Children learning to spell in typologically different systems respond differently to morphological and morpho-phonological information encoded in their respective orthographies. Israeli and Belgian children in our study treated





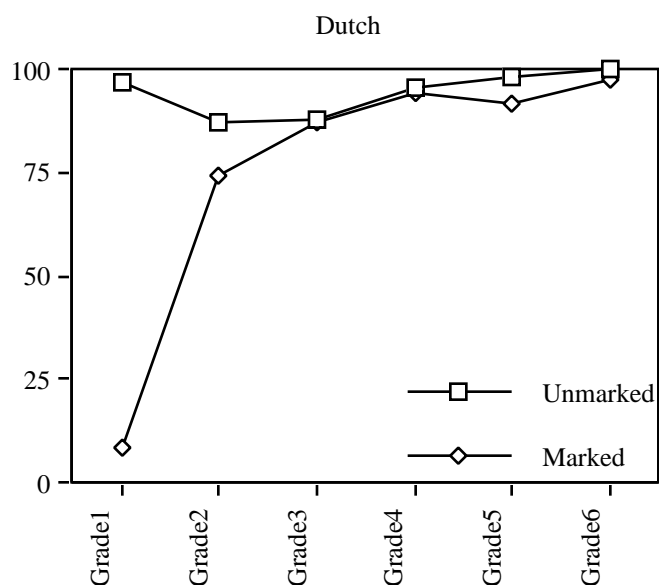


Figure 2: Percentage correct marked vs. unmarked graphemes in Hebrew and Dutch.

morphological and morpho-phonological cues differently in their spelling development: they were accessible and helpful to Hebrew speakers and far less accessible to Dutch speakers.

Morphology has two facets: a semantic or functional facet, which is mapped onto a phonological form. Therefore, exposure to a rich or a sparse morphology necessarily involves a heightened or a reduced attention to the semantics and function of morpho-phonological segments. In a synthetic language such as Hebrew, morphology is rich in both aspects. From the viewpoint of semantics/function, a broad spectrum of lexical and grammatical information is encoded in Hebrew words. A single spoken word such as *vekshehitarakt* 'and when you, Sg.Fm combed yourself' encodes 8 lexical and grammatical notions. Written Hebrew words are even more synthetic. From the viewpoint of morpho-phonology, Hebrew is not less complex: Hebrew allomorphy is both rich and diverse, encompassing both roots and stems, and consequently entailing morpho-phonological changes in suffixes and patterns. The sensitivity of young Hebrew spellers to semantic and morpho-phonological cues in learning phonology-to-orthography mapping is explained by the

typological bias created by the necessity to be attentive to all types of morphological cues from early on in their spoken language.

Dutch, in contrast, is morphologically sparse in both respects. Apart from relatively little morphology in the noun and the verb phrase, much of the effort of Dutch speaking children seems to be directed toward the acquisition of syntactic patterns such as word order (De Houwer & Gillis 1998, Wijnen & Verrips 1998). As a result, morphological cues are not good cue providers for Dutch speaking gradeschoolers, who seem to prefer rote- to rule-learning in learning to spell. Thus learning to overcome the few cases of homophonous morphologically-motivated spelling in Dutch is a protracted process which is not completed by the end of gradeschool. Even when presented by target segments with clear grammatical value, as in the affix case, young Dutch spellers do not turn to the morphological value as their first preferred choice. When phonology-orthography rather than morphological links are provided, as in the markedness case, they do well from early on.

A final conclusion of this paper is the central role linguistic characteristics and information have in the development of spelling. Morphology is expressed in both spoken and written language modalities, and orthographic systems reflect to a certain extent morphological regularities of their spoken languages. Therefore, learning to be linguistically literate in languages with alphabetical orthographies entails learning to uncover these mappings in a manner consistent with the specific language typology.

## Notes

\* Preparation of this paper was supported by a GOA grant (contract # 98/3) financed by the Flemish Government.

1. Hebrew letters are represented here by capital Latin characters.

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