

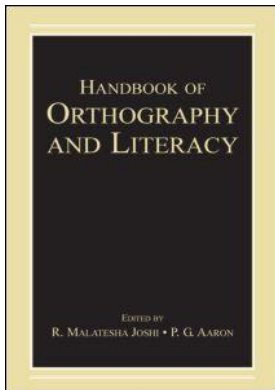
This article was downloaded by: 10.3.98.104

On: 20 Feb 2020

Access details: *subscription number*

Publisher: *Routledge*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: 5 Howick Place, London SW1P 1WG, UK



## **Handbook of Orthography and Literacy**

R. Malatesha Joshi, P. G. Aaron

### **Literacy Acquisition in Danish: A Deep Orthography in Cross-Linguistic Light**

Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9780203824719.ch3>

Carsten Elbro

**Published online on: 02 Sep 2005**

**How to cite :-** Carsten Elbro. 02 Sep 2005, *Literacy Acquisition in Danish: A Deep Orthography in Cross-Linguistic Light* from: Handbook of Orthography and Literacy Routledge

Accessed on: 20 Feb 2020

<https://www.routledgehandbooks.com/doi/10.4324/9780203824719.ch3>

**PLEASE SCROLL DOWN FOR DOCUMENT**

Full terms and conditions of use: <https://www.routledgehandbooks.com/legal-notices/terms>

This Document PDF may be used for research, teaching and private study purposes. Any substantial or systematic reproductions, re-distribution, re-selling, loan or sub-licensing, systematic supply or distribution in any form to anyone is expressly forbidden.

The publisher does not give any warranty express or implied or make any representation that the contents will be complete or accurate or up to date. The publisher shall not be liable for an loss, actions, claims, proceedings, demand or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of this material.

## 3

# Literacy Acquisition in Danish: A Deep Orthography in Cross-Linguistic Light

Carsten Elbro  
*University of Copenhagen*

Danish and English are similar in many ways. Both are Germanic languages with deep orthographies. Both in Denmark and in the United States, reading and writing are usually taught through a variety of approaches such as phonics, whole word, and whole language. Because Danish orthography also shares some basic similarities with English, Danish children would be expected to acquire reading and writing skills in ways that are similar to those of English-speaking children. This is so in spite of the fact that Danish children do not receive formal instruction in reading until the age of 7 years. The available evidence summarized in this chapter suggests that initial reading and spelling development in Danish is indeed similar to that in English.

### WHY STUDY READING IN DANISH?

Reading acquisition has been studied far more extensively in English than in any other language. This means that the standard models of reading acquisition have been developed and validated in terms of English. Little is known about how these models generalize to other alphabetic orthographies—not to mention syllabic and morphemic orthographies. Some comparisons have been made, though, between English and other, more regular, orthographies.

However, almost all of these comparisons rest on somewhat soft grounds because orthography is far from the only difference between languages. When English and French are compared, for instance, a deep orthography with many deviations from a simple one-to-one phoneme–grapheme writing system (English) is compared with a system with a much more predictable pronunciation of written words (French) (e.g., Goswami, Gombert, & Barrera, 1998). Furthermore, the two languages have rather different syllabic structures. There are also differences between the ways reading is taught in the two languages. Consequently, observed differences in reading acquisition in English and French may be difficult to interpret because they may stem from differences in orthography, language, teaching methods, and so forth. Similarly, comparisons of reading acquisition in English and German (e.g., Landerl, Wimmer, & Frith, 1997)

are probably influenced not only by differences in the orthographies—German orthography is much more shallow than English orthography—but also by differences in teaching methods. German children are initially taught to read exclusively through the synthetic phonics method, whereas initial reading instruction in English uses a mixture of methods.

These differences make Danish interesting from an international perspective, because Danish is similar to English in at least three respects: Danish, like English, is a Germanic language; Danish also has a somewhat deep orthography; and initial reading in Danish is traditionally taught by means of a variety of instructional methods, such as whole-word look-and-say, contextual cues use, some phonics, and easy book reading. We can therefore expect reading acquisition in Danish to parallel that in English.

Needless to say, there are also differences between the Danish and English orthographies. For example, unlike English, Danish has only a few vowel digraphs, mainly in French loan words that have preserved their French spelling. Danish also has three extra vowel letters (*æ*, *ø*, and *å*). Nevertheless, these differences appear to be minor when the entire language structure is taken into consideration. The basic similarities between English and Danish therefore permit us to study the effects of orthographic structure on literacy acquisition. So far, however, only a few cross-linguistic studies have been carried out, and they are presented in this chapter.

The studies in this chapter have mostly been conducted within the framework of a reading acquisition model that assumes that literacy development follows the principle of economy: That is, the most productive and reliable grapheme–phoneme associations are learned first and complex associations are learned later. This means that standard pronunciations of the single letters are learned first because, in addition to the one-to-one association, their number is also determined by how many letters are there in the alphabet. More complex grapheme–phoneme associations are acquired progressively with these simple associations used as the base, and this progressive development occurs in *overlapping waves*. This means that the knowledge of other principles of orthography is collected from early on, but each principle is made use of in spelling over a period of time.

This general model gives rise to several expectations. First, if standard pronunciations of the single letters are learned first, then any deviation from a simple grapheme–phoneme correspondence may cause difficulties for beginning readers. Even common digraphs—in which two letters regularly represent one phoneme—can be expected to cause difficulties. Second, spelling patterns in which single letters have more than one pronunciation are expected to pose difficulties for novice readers. In a language such as English with many such patterns, the acquisition of literacy skills is likely to be a protracted affair. Third, morphemic spelling patterns are expected to be a major challenge because they are based on morphology, information that is categorically different from phonology. Fourth and finally, word-specific orthographic forms that do not conform to either phonologic or morphologic conventions are expected to be the ones that will be acquired last.

### INITIAL READING DEVELOPMENT IS SLOW IN DANISH

A large-scale IEA (which stands for the International Association for the Evaluation of Educational Achievement) study of reading literacy conducted in 1922 reported that Danish 9-year-old children ranked 24th among children from 27 countries (Elley, 1992). The Danish students were on average the slowest readers among children from all participating European countries. This was found in both word decoding and in reading of narrative and expository texts. Since then, because of increased awareness about literacy education, the reading accuracy of Danish

9-year-olds has improved from below the international average to somewhat above it; but reading speed still remains relatively low (Allerup, Mejding, & Zeuner, 2001).

In Denmark, formal schooling starts when the child reaches 7 years of age. Before this, very little informal reading instruction takes place at home. Therefore, Danish children are at a position of disadvantage when compared with children of the same age in other countries where formal schooling starts when children are 6 years, or even 5 years, of age, as in Britain.

A small-scale study of initial reading development in 13 European orthographies including Danish and English (Seymour, Aro, & Erskine, 2003) indicated that Danish and English children are far behind other children by the end of the first school year. One would expect English-speaking children, because they started school much earlier, to have done better, but that did not happen. Even though Danish children knew as many letters as children from other countries and could name more than 90% of the letters by the end of the first school year, they were able to read monosyllabic nonwords with an accuracy rate of only about 60%. The corresponding figure was around 90% or higher for children who spoke other European languages. Only the English-speaking (Scottish) children read worse (40% correct) than Danish children.

By the age of 14 years, Danish youths, however, read relatively better. In the 1992 IEA study Danish youth came in at the 13th place out of 31 participating countries. This result was corroborated in the 2000 OECD PISA study (Andersen et al., 2001) in which the performance of Danish 15-year-olds came very close to the average of youths from 33 participating countries.

Together, these studies suggest that the initial phase of reading development is slow in Danish. There may be many reasons for this. The particular difficulties of the Danish orthography may be one of them; this probably is exacerbated by the relatively late school start in Denmark.

### DANISH DEPTHS

Danish orthography was already old when a national norm was first established around the year 1200. From the very beginning, Danish orthography reflected several obsolete pronunciations. For example, even though Danish words like *lov* [law] had been pronounced with a final /w/ sound for generations, scribes working during the 13th century spelled such words with a final *-gh* (*logh*) in conformity with the archaic pronunciation. Similarly, the *th* sound (as in *myth*) had long since been replaced with /ð/ (as in *with*) in the final position, yet Danish scribes continued to insert *-th* in words that did not have that sound anymore. The developmental changes in the pronunciation of spoken Danish were so numerous during the early middle ages that, by about 1300, a majority of words contained segments that made the grapheme–phoneme correspondence of these words opaque (Skautrup, 1944, 257–258).

The scribes who instituted the first national spelling norm were, without doubt, learned men, who came from various parts of the country and who spoke different Danish dialects (or regional variants). Hence one possible reason for the initial orthographic conservatism may be that the scribes may have wished to select spellings that were not based on any one spoken Danish dialect as norm. Instead, the scribes appear to have chosen old-fashioned, possibly high-status, Danish as the basis for spelling.

Whatever the reason for the initial conservatism of Danish spelling may be, things have become worse since the 1200s. Written language is by nature more conservative than spoken language. Spelling reforms usually lag far behind changes in pronunciation, and spoken Danish has changed more than most Germanic languages since the 1200s. For instance, spoken Swedish has stayed much closer than Danish to its East Nordic root, which is one major reason why Swedish orthography is much more shallow than Danish orthography.

In addition, Danish has been more accepting than most languages of foreign loan words. This means that Danish has imported many orthographic complexities along with imported words. In comparison, Norwegian spelling of loan words conforms much more closely to Norwegian spelling conventions. For example, Danish *psykologi* [psychology] has a silent *p* whereas Norwegian *sykologi* does not; in the Danish word *nation* (from the Latin), the middle /ʃ/ sound is spelled with a *t* whereas the Norwegian spelling is *nasjon*, with a standard digraph *sj*; Danish *tusch* [Indian ink, from the German] uses a German spelling of the /ʃ/ sound whereas Norwegian *tusj* uses the standard *sj*; and Danish *niveau* (from the French) has the French *eau* for the /o/ sound whereas Norwegian spelling is more simple, *nivo*.

The changes in spoken language and the influx of foreign words and their spellings from other languages are two main reasons why Danish orthography deviates from a simple phoneme–grapheme structure. In addition, some orthographies, like those of English and Danish, also represent morphology to some extent. Examples of the influence of morphology on spelling are *bomb–bombardment*, *damn–damnation*, and *boys* versus *boy’s*. Deep orthographies, such as those of English and Danish, differ from shallow ones because they reflect such morphological information even when it conflicts with simple grapheme–phoneme correspondences.

From a present-day perspective, however, the consequences of the three sources of orthographic irregularity are difficult to identify and isolate with precision. It may be pedagogically more productive to disregard the historical perspective and take a look at orthographies as they appear from a contemporary perspective. Four orthographic principles may be distinguished. For the sake of simplicity, they are presented in their order of acquisition in the next section. The first is the basic phonemic principle that is common to all alphabetic orthographies.

## TAKING THE PLUNGE

### The Alphabetic Principle 1: Standard Letter Sounds

Single, abstract letters (graphemes) represent single, abstract segments of speech (phonemes). This is the basic principle of all alphabetic orthographies—including deep ones such as those of English and Danish. This is the principle that Danish children acquire first, as we shall see.

Danish children are taught the letter names directly during the first months of Grade 1. In some cases, the introduction to the letters takes a full semester. Sometimes, but not always, letter sounds are taught along with letter names.

However, the basic alphabetic principle faces a challenge in Danish and in all other Germanic languages. There are not enough letters in the Latin alphabet to match all the phonemes. The Latin alphabet had enough letters to represent spoken Latin, but the Germanic languages that borrowed it have more sounds. The problem is particularly pressing for the Danish vowels. It can be argued that there are 12 Danish vowel phonemes that qualitatively differ from each other (Elbro, 2001). Therefore, even disregarding vowels that differ only in length, there are too few letters in the alphabet to represent all the Danish vowel phonemes. Attempts to deal with this problem have resorted to three solutions, all of which make the orthography deviate from a simple phonemic script.

First, one letter may represent more than one phoneme; for example, written *s* may represent /s/ in *press*, /z/ in *present*, /ʃ/ in *pressure*, and /ʒ/ in *pleasure*. Each Danish vowel letter regularly represents two or more different short-vowel phonemes and at least one long-vowel phoneme.

Second, special letters may be added to the Latin alphabet. Danish, like Norwegian, has three additional vowel letters, *æ* (originally *ae*), *ø* (originally *oe*), and *å* (originally *aa*).

Third, fixed letter combinations (e.g., *ng* in *ring*, and *sh* in *shoe*) can be used for representing single phonemes (/ŋ/ and /ʃ/). Such fixed letter combinations, or *complex graphemes* or *digraphs*, are very common in English; and they exist in all Germanic orthographies. The *ng* (as in *ring*) digraph is a very widespread example. Another complex grapheme in Danish is *sj* that represents /ʃ/.

*Digraphs and trigraphs are complex graphemes*

Digraphs such as *ng*, *sj*, and *sh* are fixed letter patterns that generally represent only one phoneme. Digraphs are interesting in the study of reading development because they have highly regular pronunciations on the one hand, but, on the other hand, they deviate from the basic alphabetic principle that each letter corresponds to a sound. Therefore, if children initially associate single letters with single (standard) sounds, complex graphemes should pose a problem for them. It should be harder for them to read words like *shin* with complex graphemes compared with words like *spin* and *pen*, even though *spin* has more sounds than *shin*.

To my knowledge, there has been only one study that investigated the acquisition of complex graphemes in Danish. That is the study reported below. The study also examined complex grapheme acquisition in English and German. The materials used were nonwords with complex consonant graphemes (e.g., *shig*), matched nonwords with consonant clusters instead of complex graphemes (e.g., *spig*), and matched nonwords with the same number of sounds but fewer letters (e.g., *deg*). These “words” are listed in the appendix. Details of the participants are shown in Table 3.1.

The results indicated that words with complex graphemes were significantly harder to read than both types of control words with and without consonant clusters (Table 3.2). The tendencies, with Grade 3 as an example, can be clearly seen in Fig. 3.1. The effect was confirmed for English and Danish in a repeated-measures analysis of variance with three word types  $\times$  two languages  $\times$  two grade levels and planned contrasts between the words with digraphs and the other two word types:  $F(1, 109) = 85.1, p < .001$ , and  $F(1, 109) = 137.9, p < .001$ , respectively. Grade level had a significant main effect:  $F(1, 109) = 6.6, p < .05$ . Language did not significantly interact with other factors.

A second analysis of variance looked at all three languages and Grades 3 and 4 (between subjects), but only two word types (within subjects). This analysis indicated a strong main effect of word type,  $F(1, 146) = 125.8, p < .001$ ; a main effect of grade level,  $F(1, 146) = 4.7, p < .05$ ; and an effect of language,  $F(2, 146) = 12.6, p < .001$ . A post hoc test (Scheffé,

**TABLE 3.1**  
The Participants

<i>Language</i>	<i>Grade Level</i>	<i>N</i>	<i>Mean Age</i> <i>Mean Age</i>	<i>SD</i>
English	3	30	7,4	0,4
(Scottish)	4	30	8,6	0,4
German	1	13	7,5	0,6
(Austrian)	2	20	8,3	0,4
	3	20	9,1	0,4
	4	19	10,4	0,4
Danish	3	19	9,11	0,4
(proper)	4	34	10,8	0,6

**TABLE 3.2**  
Mean Reading Accuracy of Nonwords With Complex Consonant Graphemes, Consonant Clusters, and Simple Consonant Graphemes in Three Languages

Language	Grade Level	Consonant Graphemes		
		Digraphs	Clusters	Simple
English	3	53.7 (26.6)	73.3 (27.9)	74.3 (24.0)
	4	62.2 (20.3)	80.0 (22.5)	82.7 (18.4)
Danish	3	57.9 (23.3)	70.2 (24.9)	77.8 (24.6)
	4	70.6 (21.9)	84.3 (20.7)	87.9 (15.1)
German	1	67.3 (27.7)	—	92.3 (12.0)
	2	73.8 (19.0)	—	92.5 (18.3)
	3	80.0 (17.4)	—	93.8 (13.8)
	4	81.6 (14.0)	—	92.1 (16.8)

Note. Standard deviations are given in parentheses.

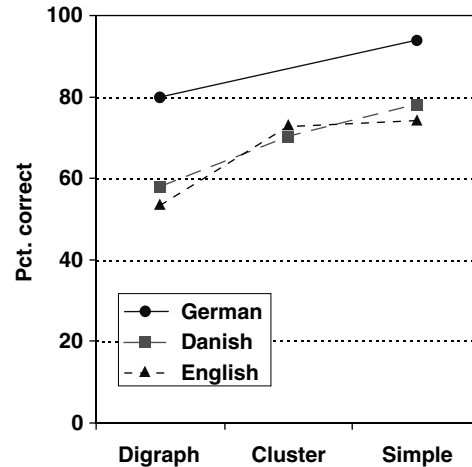


FIG. 3.1. Reading accuracy in grade 3 in three languages with words containing digraphs (e.g., *shig*) compared with consonant clusters (e.g., *spig*) and simple consonants (e.g., *deg*).

$p < .05$ ) indicated that the language effect was caused by significantly higher scores in German than in both Danish and English. None of the interaction effects was significant.

The results of this study support three general hypotheses. First, it is obvious that German children who learn to read a relatively shallow orthography by means of a synthetic phonics approach develop basic decoding skills more rapidly than do English and Danish children.

Second, the results support the hypothesis that deviations from the basic alphabetic principle—that each grapheme represents one phoneme—are acquired more slowly. These letter patterns challenge beginning readers in all alphabetic orthographies regardless of the depth of the orthography. Not only English and Danish children were affected by complex graphemes; readers of the more regular German orthography were also affected. It should also be noted that the complex graphemes had a disruptive effect on children's reading even though the complex graphemes have predictable pronunciations in both Danish and German.

Third, the results are in accordance with the general idea that reading development starts with the acquisition of the basic alphabetic principle, that is, learning the phonemes associated with each letter of the alphabet.

### The Alphabetic Principle 2: Letter Patterns

As spoken Danish has continued to develop, orthographic conservatism has resulted in many inconsistencies between spelling and sound. Many of these orthographic complexities are nonetheless rather predictable because the changes in pronunciation have occurred in similar sound contexts across many words. The general development means that regularities may still exist between *strings* of letters and the corresponding *strings* of sounds—even though the *individual* grapheme–phoneme relationships have become opaque. For example, consider how the standard sound of written *o* and *ou* is modified by context in English (collected from Carney, 1994):

- o*- → /ɒ/ (*hot, mob*)
- ou*- → /aʊ/ (*doubt, about*)
- ough* → /ʊ/ (*though, dough*)
- ought* → /ɔ:/ (*ought, thought*)

Note that the letter pattern *-ought* has a completely predictable pronunciation as a whole (this rime is pronounced the same way in all words) although the individual letters of the pattern have mostly nonstandard pronunciations. Another example is the so-called magic *e-* rule in English. A final *e-* changes the vowel in words like *cape* and *bite* from the short standard sounds /æ/ as in *cap* and /ɪ/ as in *bit* into tense (long) variants, /eɪ/ and /aɪ/. In other words, *a* and *i* receive *conditional* pronunciations in words with final *e*'s.

Similar situations exist in most alphabetic orthographies, even though they many not have as many in English. The regularities of letter patterns exist *above* the single-letter–sound level, but *below* the morphemic and lexical levels. Implicit knowledge of letter patterns is likely to be an important part of the internalized orthographic code (or the *cipher*). An overview of the most common letter patterns in Danish may be seen in Elbro (2001, p. 78–79). A detailed account of Danish letter-to-sound correspondences is provided in Becker-Christensen (1988).

The acquisition of regular letter patterns (such as *-ought* and *-ake*) was studied with the same groups of schoolchildren who took part in the preceding study of digraphs. The study focused on patterns in which the vowel letter receives a conditional pronunciation, because such patterns are very common in Danish. The expectation was that words with conditional vowel pronunciations would be more difficult to learn than words with standard pronunciations—indicating that conditional pronunciations are learned *later* than standard pronunciations. The materials were nonwords with vowel letters with a conditional pronunciation (e.g., *pake*) and matched nonwords in which the same vowel letters had standard pronunciations (e.g., *pask*). The English part of the study was also conducted with real words. The materials are listed in the appendix.

The results showed significant effects of letter patterns with conditional letter sounds in both languages and at each grade level (Elbro et al., 2000; Juul & Elbro, 2001) (see Fig. 3.2). A repeated-measures ANOVA with two word types × two languages × two grade levels showed a significant main effects of word type,  $F(1, 109) = 81.7, p < .001$ ; grade level,  $F(1, 109) = 8.7, p < .01$ ; and language,  $F(1, 109) = 8.1, p < .01$ ; and a significant interaction effect of word type and language,  $F(1, 109) = 8.4, p < .01$ . The analysis thus suggests that nonwords such as *pake* were significantly harder to read than nonwords with standard sounds such as *pask* for both third and fourth graders. The same was found with English real words, even



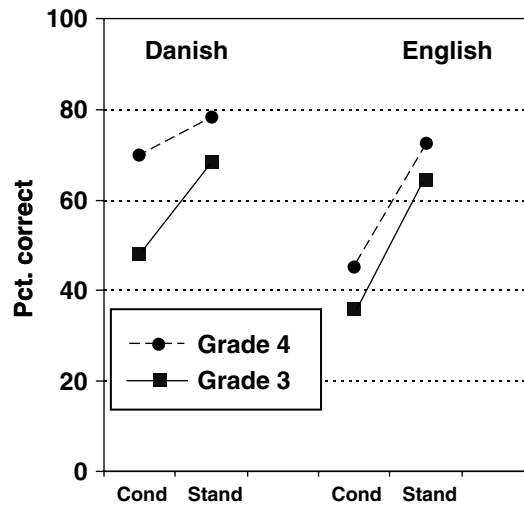


FIG. 3.2. Reading accuracy with words with conditional versus standard vowel letter sounds. Means are shown for grades 3 and 4 in Danish and English.

though the effect was significantly smaller in Danish. This difference in orthographic effect suggests that Danish children are about to master the conditional vowel grapheme–phoneme rules by Grade 4 whereas the English-speaking children have a longer way to go.

The fact that words with conditional pronunciations are relatively difficult indicates that orthographies with such conditional pronunciations are more difficult to learn than other, more regular orthographies. The parallel results for Danish and English suggest that letter patterns with conditional vowel letter pronunciations are a general problem, regardless of the language.

### *Vowel Length*

The orthographic representation of vowel length is no problem in Latin because vowel length is not distinctive. It is, however, a potential problem in Germanic languages and in many other languages (including Finnish and Greenlandic) in which vowel length (or tenseness) is distinctive. Many languages use more than one way to represent vowel length. A simple doubling (gemination) of a letter that represents a long sound (as opposed to a short one) would seem the most straightforward way. This is the principle used by both Greenlandic and Finnish, which have very regular orthographies. Nevertheless, the acquisition of the representation of phoneme length appears to be a problem in both languages (e.g., Jacobsen, 1994). The difficulty may be similar to the one with digraphs—two letters representing one sound.

The most common way of representing short, stressed vowels in Danish is by *consonant doubling* (in polysyllabic words). It works as in English to distinguish between, for example, *bitter* with a short (lax) vowel and *biter* with a long (tense) vowel. The convention is, of course, used very frequently. Not surprisingly, it is also acquired from an early point in both reading and writing Danish (Elbro et al., 2000; Juul, 2004).

One major problem in Danish orthography is that the convention for representing vowel length is not used consistently with unstressed vowels. Although it is relatively safe to assume that double consonants are preceded by a short vowel in Danish, a single consonant is less reliably associated with a long vowel. Therefore, for unstressed vowels, word-specific knowledge is needed, and this is acquired rather slowly (Juul, 2004).

### *Rime Analogy Is Not a Flotation Device*

The orthographic rime comprises the vowel letter and the consonants that follow it. The status of the rime in the development of decoding is controversial (e.g., Bowey, Vaughan, & Hansen, 1998). On the one hand, it is clear that many regular orthographic patterns coincide with the rimes; and it is generally the case that consonants after the vowel exert greater influence on the pronunciation of the vowel than consonants before the vowel. On the other hand, there is such a large number of different rimes that it would seem a rather uneconomic strategy to try to internalize their individual pronunciations.

A more economic strategy would be to internalize the *minimal* letter patterns that predict a conditional pronunciation. For example, in Danish it would be economic to remember the conditional pronunciation of *-u* as /ʊ/ when it is followed by an *-m* (as opposed to the standard pronunciation /u/ as in *bus* [bus]). This minimal rule would cover several rimes at once, for example, *-umf*, *-ums*, and *-umt*, in addition to the simple *-um*. Therefore, each of these rimes and their pronunciations would *not* have to be stored separately.

The presence of a digraph in the rime should *not* pose any particular problem to the reader if the rime is recognized as a whole. In such cases, the frequency of the rime as a whole would be an important predictor of how easily the word is read. On the other hand, if rimes are not recognized as wholes, their internal structure is likely to play a role. In that case, the frequency of digraphs in the rimes will be an important predictor of how easily the word is read. These two hypotheses were assessed by means of the data from the study of the impact of digraphs. A plot of the relation between digraph frequency and reading accuracy is shown in Fig. 3.3(a), and rime frequency is plotted against reading accuracy in Fig. 3.3(b). The Danish reading data are averages across Grades 3 and 4.

It is clear that the frequency of the digraphs [Fig. 3.3(a)] provided a much better fit to the reading scores than did the frequency of the rimes [Fig. 3.3(b)]. Unfortunately, the English words were not ranked differently according to digraph and rime frequencies, so a comparison

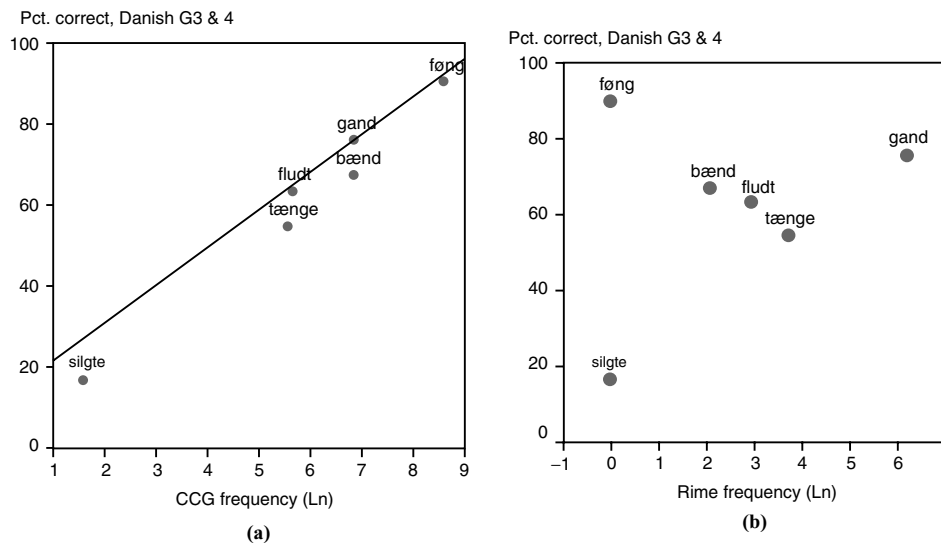


FIG. 3.3. (a) Reading accuracy in Danish plotted against the frequency of the complex consonant graphemes (CCGs.) in the words; (b) the same reading performance but now plotted against the frequencies of the rimes that contained the CCGs.

**TABLE 3.3**  
Danish Study of Effects of Rime (VCC) vs. Small Unit (VC) Frequency

VC	Rime	
	+ Frequent	– Frequent
+ Frequent	–ink ...	–ins ...
– Frequent	–uft ...	–ums ...

is not possible. However, the Danish results suggest that digraphs are dealt with as problem units rather than as an integral part of the whole rime.

A study by Shkoza (2000) confirmed this result. She studied the effects of planned contrasts between words with high- versus low-frequency rimes and high- versus low-frequency vowel–consonant combinations. (See Table 3.3 for an overview of the contrasts with examples of rimes). In this comparison, all the test words had conditional vowel pronunciations; but there were also some filler words with standard vowel pronunciations. The participants were Danish school children from grades 2 to 4.

The results were very clear in that only the frequency of the relevant spelling pattern (the vowel–consonant combination) influenced reading accuracy. The rime frequency of which the pattern was a part did not.

Again, these results are in line with the general idea that children adopt a principle of economy as they internalize the conventions of the orthography. Small orthographic units are more productive, and hence more economical, than large units.

Nonetheless, whole rimes may be useful entities in reading instruction. The corresponding rhymes are easily accessible and well known from poetry and language games. Therefore the regular spelling of some rimes may be useful for demonstrations of regularities above the single-letter level. It is unlikely, however, that *rhyme analogy* in general is a major strategy in reading development in Danish—even though Danish orthography has many irregularities.

### BOYS WILL BE BOY'S

#### The Morphemic Principle in Spelling

Sometimes spelling reflects the morphological structure of the word rather than just the phonemic structure. The smallest meaningful unit, a morpheme, may sometimes be spelled in only one way in spite of variations in pronunciation, as is the case with the *-ed* past-tense ending that is pronounced /d/, *beamed*; /t/, *dropped*; or /td/, *rested*; depending on the end of the verb root. In the case of the *-ed* ending, the morphemic principle overrules the phonemic principle and causes the orthography to increase in depth.

Learning to use the morphemic principle appears to be a long-lasting problem for Danish schoolchildren. The problems in Danish are similar to problems in English. Danish also has a number of homophones that are spelled differently. For example, verbs with roots that end in *-r* (e.g., *bor* [the root of *drill*]) have identically sounding infinitives and present-tense forms that are spelled differently, *at bore* [to drill] and *borer* [drills], respectively. The derived noun, *en borer* [a driller], is also a homophone. Other examples are the homophones *-ene* (plural

definite noun) versus *-ende* (present participle of verb) and *-ed* (end of some noun roots) versus *-et* (past participle of verbs). These word endings can be spelled correctly only by reference to the morphological structure.

In a cross-sectional study of 142 Danish students from Grades 4, 6, 8, and 10, Juul and Elbro (2004) found that the silent *r* and similar morphologically determined letters were applied correctly in only about 50% of the items, even by children in Grade 8; by Grade 10, their accuracy was about 90%. When errors occurred, it was almost always because students provided a standard spelling of the sound pattern they heard. Hence the results of the study indicated that morphological spelling knowledge is indeed acquired over a long period of time.

### SEEING READ IN READY

#### The Morphemic Principle in Reading

The role of morphological decomposition in decoding is a controversial issue. However, once the reader has learned to recognize the root word such as *read*, this orthographic knowledge would be helpful in reading words that contain that root (e.g., *reads*, *reading*, *reader*, *unreadable*, *readability*, etc.).

A major problem with prelexical morphological decomposition is that it cannot distinguish between real morphemes and pseudomorphemes. Before a word is recognized, it is impossible to know whether or not a particular letter string is in fact the morpheme it looks like. For example, *read* might be a root in *ready* but it is not, and *car* might be a root in *carrot* but it is not. As pointed out by Taft (1981) and others, high-frequency prefixes may facilitate decoding based on morpheme analysis; but the evidence is not very strong.

However, morphological analysis may be used as a compensatory strategy by dyslexic readers. In one study, Elbro found that dyslexic adolescents rely more on morphological word structure than do younger typical readers with a similar level of word decoding ability (see Elbro and Arnbak, 1996). In comparison, there was a significantly smaller effect of morphology on a group of younger typical readers matched for reading level (Elbro, 1990).

### WORD-SPECIFIC SPELLING–SOUND RELATIONS

When spelling patterns and the morphemic principle are taken into account, deep orthographies are not as unpredictable as they might seem at first. Nevertheless, Danish has very many words in which one or more letters have unique pronunciations. This is the case for some highly frequent words that have preserved their odd spelling precisely because they are so common, for example Danish *de* [they] pronounced with an /i/ rather than standard /e/ or /e/, or any of the conditional pronunciations. Other examples are Danish *af* [of, from] with a silent *f*, *kobber* [copper] with /w/ for written *b*, and *otte* [eight] with a nonstandard, long vowel /ɔ:/ for written *o*. In addition, there are numerous words of foreign origin that have preserved their non-Danish spellings. Examples are relatively new loan words from French and English such as *mayonnaise*, *gear*, and *juice* (the unique spellings are emphasized).

In addition to these words with unique spelling-to-sound relationships, there are many inconsistent spelling patterns in Danish (as in English). For example, the *-uk* pattern is pronounced /ɔk/ in some words (e.g., *luk* [close]) and /uk/ in other words (e.g., *kluk* [cluck]). As a consequence, the reader needs lexical orthographic knowledge.

The general framework for understanding reading development put forward in this chapter would predict that such word-specific spellings are acquired late in reading development. Unfortunately, there are very few studies of reading in Danish that have tested this prediction. There is good evidence from English, however, that word-specific orthographic knowledge

is indeed acquired relatively late (when word frequency is controlled). Zinna, Liberman, and Shankweiler (1986, exp. 1) studied children's reading of three types of words: words with standard letter sounds (e.g., *green, paint*), words with consistent spelling patterns (e.g., *beach, mount*), and words with inconsistent spelling patterns (e.g., *steak, touch*). It was very clear that children in Grades 3 and 5 made many more errors in the words with inconsistent spelling patterns than in the words with consistent patterns, whereas the words with standard letters sounds were the easiest. Not surprisingly, these differences were especially large for low-frequency words. The results suggest that word-specific letter pronunciations are indeed learned later than words with consistent letter-sound patterns.

One Danish study has compared acquisition of spelling patterns and word-specific spelling (Juil, 2003). In this study, 140 children in Grades 4 and 6 were asked to spell words with consistent standard spellings (e.g., /i/ spelled *i*), words with consistent conditional spelling (e.g., /e/ spelled *i* before /s/), and words with inconsistent spellings (e.g., /ε/ spelled *æ* before /s/). Both vowels and consonants were studied as the critical segments of the words. The results supported the hypothesis about the developmental sequence: Proficient spellers were at or near ceiling with both standard spellings and consistent conditional spellings, but less adept with the word-specific spellings. Poor spellers were good at standard spellings, but lagged behind in both consistent conditional spellings and word-specific spellings. Together, the results are in line with the general idea that the acquisition of orthographic knowledge starts with standard letter-sound relationships and progresses toward less common and less productive orthographic patterns.

## CONCLUSIONS

Danish is a Germanic language with a comparatively deep orthography. Reading and writing are usually taught by a mixed approach in Danish schools. Hence Danish has some basic similarities with English, and Danish children would be expected to acquire reading and writing abilities in ways that are somewhat similar to those of English-speaking children—even though Danish children do not receive formal instruction in reading until the age of 7 years. The available evidence summarized in this chapter suggests that initial reading and spelling development in Danish is, indeed, similar to that of English.

Almost all comparisons between reading in English and in other languages have focused on differences that are hypothesized to be consequences of the deeper English orthography. Comparisons with Danish are particularly interesting because they make it possible to see whether the orthographic complexities that are generally presumed to be a challenge to English readers are also problems to readers in other languages. Some complexities such as digraphs exist even in shallow orthographies such as German. There is now some evidence that digraphs do seem to be a challenge across orthographies—even when there are few of them and even if the orthography is shallow. This finding has far-reaching implications. One implication is that such possibly universal complexities may reflect universal phases (or trends) in reading development: Some aspects of orthographies (the complexities) are learned *after* the standard grapheme-phoneme correspondences are learned. Another implication is that cross-orthographic complexities provide a metric for comparisons of the relative difficulty of orthographies; in principle, it is possible to measure the complexities of orthographies.

The complexities of the Danish orthography are obviously not mastered all at once. The results from recent studies of reading and spelling acquisition in Danish conform to a general framework for the development of reading and writing: Short letter patterns are learned more quickly than patterns comprising many letters, and consistent (reliable) patterns are learned more quickly than inconsistent ones.

At least four different developmental waves can be distinguished during literacy development in Danish (and English) (cf. Siegler, 1986):

*Wave 1. Learning of Single-Letter–Single-Sound Correspondences.* The dominant strategy during the initial phase of learning to read and write is to associate one sound with one letter and one letter with one sound. The preferred sound is often the one present in the letter name. This strategy results in problems with digraphs and all other forms that deviate from simple letter–sound relationships.

*Wave 2. Learning of Letter–Sound Patterns With Conditional Pronunciations.* Conditional pronunciations (e.g., *mat, mate; rat; rate*) are learned at first in the smallest possible units (e.g., vowel–consonant combinations) rather than as part of bigger units (e.g., rimes).

*Wave 3. Learning of Spelling Based on Morphemic Orthographic Knowledge.* These patterns are acquired relatively late. Even the spellings of some frequently occurring morphemes continue to be a challenge when they are distinguished in spelling, but not in pronunciation, such as the genitive apostrophe in English or the present tense *–r* in Danish. However, some morphographic units with invariant spelling of morphemes, such as the *–ed* verb ending, are learned earlier.

*Wave 4. Learning of Word-Specific Orthographic Patterns.* This is a lifelong process. Needless to say, some high-frequency words are learned as whole patterns (“sight words”) from the very beginning of reading development. Although the orthographic representations of individual morphemes (or words) may be recognized following only a few presentations, there are so many of them that their acquisition is never really complete.

## APPENDIX

### Materials in the Study of Digraphs

<i>Language</i>	<i>Digraph</i>	<i>Consonant Cluster</i>	<i>Simple Consonant</i>
Danish	sjål	spål	jål
	føng	føsp	føm
	gand	gasp	gan
	hvam	svam	vam
	hjælle	pjælle	jælle
	tænge	tækle	tæse
	silgte	silste	silte
	bænd	bælk	bæn
	fludt	flusk	flut
	English	shig	spig
dack		besk	cag
ladge		dand	pon
knop		skop	mun
wemb		famp	bip
ling		twid	tud
shid		spid	deg
dotch		twonk	pon
wrin		trin	rit
German		schore	
	bung		bun
	dech		def
	kosch		kos

## Materials in the Study of Conditional Vowel Letter Sounds

<i>Language</i>	<i>Conditional</i>	<i>Standard</i>
English	pake	pask
	bline	blin
	clind	clend
	nold	nond
	peather	deacher
	wab	wak
	squas	squag
	whap	whang
	rall	bramp
	hode	hont
	dyth	yath
	Danish	kotter
fumme		jalle
ginse		hamse
gosse		gøser*
vunke		biffe
tummer		siffen
tejser		fæbes*
mølse		dæske
gimme		mæsle

\*Two Danish nonwords with long vowels gave rise to many errors. They were subsequently left out of the data analyses.

## ACKNOWLEDGMENTS

Many of the studies summarized in this chapter were carried out with support from the Danish Research Council for the Humanities (contract No. 9602075). The Scottish part of the study was conducted by Philip H. K. Seymour, and data were collected by Jane Erskine. The Austrian part of the study was conducted by Karin Landerl. Data for the Danish part of the international study were collected by Louise Rønberg, Mette Nygaard Petersen, and Line Dahl Jørgensen. The author thanks all these collaborators, participants, and their teachers.

## REFERENCES

- Allerup, P., Mejding, J., & Zeuner, L. (2001). *Færdigheder i læsning og matematik. Udviklingstræk omkring årtusindskiftet* [Reading and math abilities. Developmental trends around the turn of the decennium]. Copenhagen: Socialforskningsinstituttet.
- Andersen, A. M., Egelund, N., Jensen, T. P., Krone, M., Lindenskov, L., & Mejding, J. (2001). *Forventninger og færdigheder—danske unge i en international sammenligning* [Expectations and abilities. Danish youths in an international comparison]. Copenhagen: Socialforskningsinstituttet.
- Becker-Christensen, C. (1988). *Bogstav og lyd. Dansk retskrivning og rigsmålsudtale* [Letter and sound. Danish spelling and received pronunciation]. Copenhagen: Gyldendal.
- Bowey, J. A., Vaughan, L., & Hansen, J. (1998). Beginning readers' use of orthographic analogies in word reading. *Journal of Experimental Child Psychology*, 68, 108–133.
- Carney, E. (1994). *A survey of English spelling*. London: Routledge.
- Elbro, C. (1990). *Differences in dyslexia. A study of reading strategies and deficits in a linguistic perspective*. Copenhagen: Munksgaard.
- Elbro, C. (2001). *Læsning og læseundervisning* [Reading and the teaching of reading]. Copenhagen: Gyldendal.
- Elbro, C., & Arnbak, E. (1996). The role of morpheme recognition and morphological awareness in dyslexia. *Annals of Dyslexia*, 46, 209–240.

- Elbro, C., Juul, H., Shkoza, B. H., Wimmer, H., Landerl, K., Seymour, P. H. K., & Wood, R. (2000, July 24–28). *Conditional letter sounds and reading development in different orthographies*. Paper presented at the International Congress of Psychology, Stockholm.
- Elley, W. B. (1992). *How in the world do students read? IEA study of reading literacy*. The Hague: The International Association for the Evaluation of Educational Achievement.
- Goswami, U., Gombert, J. E., & Barrera, L. F. (1998). Children's orthographic representations and linguistic transparency: Nonsense word reading in English, French and Spanish. *Applied Psycholinguistics*, 19, 19–52.
- Jacobsen, B. (1994). *Grønlandsk læseundersøgelse: en ortografisk, fonologisk og morfologisk undersøgelse* [Greenlandic reading investigation: An orthographic, phonological and morphological study]. Unpublished doctoral dissertation. Copenhagen: University of Copenhagen.
- Juul, H. (2003). Typer af stavefejl og typer af stavefærdighed [Types of spelling errors and types of spelling ability]. *Danske Talesprog*, 4, 59–74.
- Juul, H. (2004). *Knowledge of context sensitive spellings as a component of spelling competence: Evidence from Danish*. *Applied Psycholinguistics* (in print).
- Juul, H., & Elbro, C. (2001). Når bogstavets lyd afhænger af sammenhængen. Om tilegnelsen af videregående afkodningsfærdighed [When the letter sound depends on the context. On the acquisition of advanced decoding ability]. *Psykologisk Pædagogisk Rådgivning*, 38, 3–13.
- Juul, H., & Elbro, C. (2004). The links between grammar and spelling: A cognitive hurdle in deep orthographies? *Reading and Writing: An Interdisciplinary Journal*, 17 (in press).
- Landerl, K., Wimmer, H., & Frith, U. (1997). The impact of orthographic consistency on dyslexia: A German–English comparison. *Cognition*, 63, 315–334.
- Rittle-Johnson, B., & Siegler, R. S. (1999). Learning to spell: Variability, choice, and change in children's strategy use. *Child Development*, 70, 332–348.
- Seymour, P. H., Aro, M., & Erskine, J. M. (2003). Foundation literacy acquisition in European orthographies. *British Journal of Psychology*, 94, 143–174.
- Shkoza, B. H. (2000). *Rimstrategier ved afkodning—en undersøgelse af Læsere i 2. til 4. klasse*. ('Rime analogy strategy in decoding—a study of readers in 2nd to 4th grades'). Copenhagen: University of Copenhagen (unpublished thesis).
- Siegler, R. S. (1986). *Children's thinking*. Englewood Cliffs, NJ: Prentice-Hall.
- Skautrup, P. (1944). *Det danske sprogs historie* [The history of the Danish language] (Vol 1). Copenhagen: Gyldendal.
- Taft, M. (1981). Prefix stripping revisited. *Journal of Verbal Learning and Verbal Behavior*, 20, 289–297.
- Zinna, D. R., Liberman, I. Y., & Shankweiler, D. (1986). Children's sensitivity to factors influencing vowel reading. *Reading Research Quarterly*, 21, 465–479.