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Foundation literacy acquisition in European orthographies

Philip H. K. Seymour[1]*, Mikko Aro[2] and Jane M. Erskine[1,2]
in collaboration with COST Action A8 network[2]
[1]University of Dundee, Scotland, UK
[2]University of Jyväskylä, Finland

Several previous studies have suggested that basic decoding skills may develop less effectively in English than in some other European orthographies. The origins of this effect in the early (foundation) phase of reading acquisition are investigated through assessments of letter knowledge, familiar word reading, and simple nonword reading in English and 12 other orthographies. The results confirm that children from a majority of European countries become accurate and fluent in foundation level reading before the end of the first school year. There are some exceptions, notably in French, Portuguese, Danish, and, particularly, in English. The effects appear not to be attributable to differences in age of starting or letter knowledge. It is argued that fundamental linguistic differences in syllabic complexity and orthographic depth are responsible. Syllabic complexity selectively affects decoding, whereas orthographic depth affects both word reading and nonword reading. The rate of development in English is more than twice as slow as in the shallow orthographies. It is hypothesized that the deeper orthographies induce the implementation of a dual (logographic + alphabetic) foundation which takes more than twice as long to establish as the single foundation required for the learning of a shallow orthography.

There has been much recent attention to the possibility that the ease of reading acquisition may vary between languages because of differences in 'orthographic depth' (Frost, Katz, & Bentin, 1987). Much of this attention has focused on a contrast

* Requests for reprints may be addressed to Philip H. K. Seymour, Department of Psychology, University of Dundee, Dundee, DD1 4HN, UK (e-mail p.h.k.seymour@dundee.ac.uk).

[2] National representatives of the EC COST Action A8, especially: H. Wimmer, University of Salzburg, Austria; J. Leybaert, Université Libre de Bruxelles, Belgium; C. Elbro, University of Copenhagen, Denmark; H. Lyytinen, University of Jyväskylä, Finland; J.-E. Gombert, University of Brittany, and M. T. le Normand, Hôpital de la Salpêtriére, France; W. Schneider, University of Würzburg, Germany; C. Porpodas, University of Patras, Greece; H. Ragnarsdottir, University of Rekjavik, Iceland; P. Tressoldi and C. Vio, University of Padova, Italy; A. de Groot, University of Amsterdam, and R. Licht, Free University, Netherlands; F.-E. Tùnnessen, Stavanger University College, Norway; S. L. Castro, University of Porto, and L. Cary, University of Lisbon, Portugal; S. Defior, and F. Martos, University of Granada, Spain; and Å. Olofsson, University of Umeå, Sweden.

between English, which is regarded as a deep orthography containing many inconsistencies and complexities, and other alphabetic European languages, several of which have shallow orthographies with consistent grapheme–phoneme correspondences. For example, Wimmer and Goswami (1994) compared reading of digits, number names and nonwords formed by exchanging the onsets and rimes of number names by 7-, 8- and 9-year-old children in German and English. Nonword reading was significantly slower and more error prone in English at all three age levels. Frith, Wimmer, and Landerl (1998) used structurally equivalent sets of 1-, 2- and 3-syllable nonwords in English and German and again found consistently poorer nonword reading in English. Similar data are reported for comparisons of English with Spanish and French by Goswami, Gombert, and de Barrera (1998) and with Greek by Goswami, Porpodas, and Wheelwright (1997). These studies suggest that the decoding process, which is commonly assigned a central role in theoretical accounts of reading acquisition (Ehri, 1992; Gough & Hillinger, 1980; Share, 1995), develops more slowly and less effectively in English than in other European languages.

The present study extends this work to a comparison of English with a wider range of European languages and also seeks to determine the stage in reading acquisition at which the orthographic depth effect becomes evident. The theoretical context is provided by the foundation literacy framework developed by Seymour (1990, 1997, 1999). This proposes that reading is acquired in phases, such that basic foundational components are established in Phase 1 while the complexities of orthographic and morphographic structure are internalized in Phases 2 and 3. A simplified version of the model is shown in Fig. 1. The foundation consists of two processes, a logographic process involved in the identification and storage of familiar words, and an alphabetic process which supports sequential decoding. Both of these processes are held to be dependent on the availability of letter-sound knowledge (Ehri, 1992, 1997). In their turn, the foundations underpin the development of an orthographic framework in which the full complexity of the spelling system is represented in an abstract generalizable format (Plaut, McClelland, Seidenberg, & Patterson, 1996). Reading acquisition is

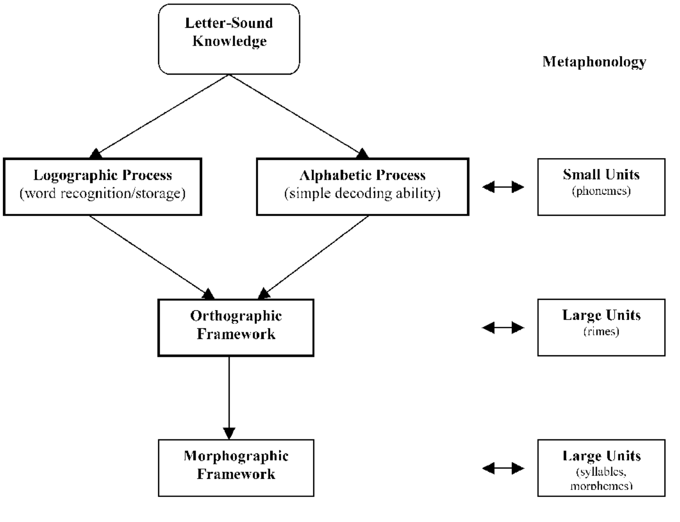

Figure 1. Schematic representation of the dual foundation model of orthographic development (from Duncan & Seymour, 2000).

paralleled by developments in linguistic awareness. It is supposed that small units (phonemes) are emphasized during Phase 1 and larger units (rimes, syllables, morphemes) during Phases 2 and 3.

Seymour and Evans (1999) devised simple procedures for the measurement of the components of foundation literacy. These were: (1) giving sounds for individual letters and writing letters in response to their sounds (letter knowledge); (2) reading very familiar words (logographic foundation); and (3) reading aloud and writing to dictation simple CVC nonwords (alphabetic foundation). The procedures were applied to unselected groups of Scottish children in the Primary 1 year (age 5 years) and in the Primary 2 year (age 6 years). Letter-sound knowledge was found to be complete before the end of the first school year. Development of the logographic and alphabetic foundations was closely linked to reading age and advanced towards an asymptote at about 7 years of reading age. A further delay of one or more years was found among samples of children drawn from disadvantaged (low SES) areas (Duncan & Seymour, 2000).

The simple model set out in Fig. 1 suggests two hypotheses regarding the relationship between foundation literacy acquisition and the orthographic complexity of the language which is being learned. One possibility is that foundation acquisition precedes the formation of an orthographic framework. If so, we could expect to find that the development of the foundation components occurred in an approximately equivalent way in the different languages and that the effects of orthographic complexity emerged only later when the orthographic framework was formed. Alternatively, it could be that the presence of orthographic complexity exerts effects from the very beginning of learning to read. In this case, foundation literacy acquisition would be expected to advance more slowly in deep orthographies than in shallow orthographies.

Language differences

The study aims to test for differences in rates of acquisition of the components of foundation literacy in European languages which vary significantly in orthographic complexity. This variation has not yet been submitted to a comprehensive computational linguistic analysis (but see Peereman & Content, 1997, 1999; Ziegler, Jacobs, & Stone, 1996; Ziegler, Stone, & Jacobs, 1997, for steps in this direction). Nonetheless, there is agreement that some European orthographies are relatively shallow (Finnish, Greek, Italian, Spanish, German) while others are deeper in the sense of containing more inconsistent correspondences as well as morphological influences on spelling (Portuguese, French, Danish, English).

The opportunity to carry out the study was provided by an EC network (COST Action A8) which brought together researchers from 16 European countries who shared an interest in reading acquisition and dyslexia (Niessen, Frith, Reitsma, & Öhngren, 2000). One part of this cooperation entailed a review of the characteristics of the European orthographies which were thought likely to affect reading acquisition. On this basis, it was proposed that it should be possible to classify the orthographies on the twin dimensions of (1) syllabic complexity, and (2) orthographic depth. The first dimension refers principally to the distinction between the Romance languages, which have a predominance of open CV syllables with few initial or final consonant clusters (e.g. Italian, Spanish), and the Germanic languages, which have numerous closed CVC syllables and complex consonant clusters in both onset and coda position (e.g. German, Danish, English). The orthographic depth dimension contrasts alphabetic writing systems which approximate a consistent 1:1 mapping between letters and phonemes (e.g. Finnish) with those which contain orthographic inconsistencies and complexities, including multi-letter graphemes, context dependent rules, irregularities, and morphological effects (e.g. French, Danish).

Table 1. Hypothetical classification of participating languages relative to the dimensions of syllabic complexity (simple, complex) and orthographic depth (shallow to deep)

		Orthographic depth				
		Shallow				Deep
Syllabic structure	Simple	Finnish	Greek Italian Spanish	Portuguese	French	
	Complex		German Norwegian Icelandic	Dutch Swedish	Danish	English

Table 1 identifies the languages involved in the research and sets out a hypothetical classification of the orthographies in terms of the dimensions of syllabic complexity and orthographic depth.[1] The expectation is that the difficulty of acquiring literacy will increase as one moves from simple to complex syllabic structures, and from shallow towards deep orthographies. Hence, if linguistic complexity affects the foundation phase of acquisition, it is hypothesized that the initial steps in reading will be traversed more rapidly in languages with simple syllabic structure than in languages with complex syllabic structure, and that acquisition will be slower in deeper orthographies than in shallow orthographies.

General method

The collaborators coordinated the preparation of test materials and the collection and coding of the data according to guidelines agreed by the COST A8 group. The group aimed to make formally equivalent assessments in each of the participating languages of the components of foundation literacy identified by Seymour and Evans (1999).

Lists

There were three sets of lists designed to assess: (1) letter knowledge; (2) very familiar word identification; and (3) decoding of simple nonwords (see Appendix).

[1] Frost et al. (1987, p. 104) state: 'In a shallow orthography, the phonemic and orthographic codes are isomorphic; the phonemes of the spoken word are represented by the graphemes in a direct and unequivocal manner. In contrast, in a deep orthography, the relation of spelling to sound is more opaque. The same letter may represent different phonemes in different contexts; moreover, different letters may represent the same phoneme.' The COST A8 representatives completed an 'orthographic questionnaire' in which they estimated the extent of variability in their own languages. These estimates were then debated and formed the basis of the hypothetical classification set out in Table 1.

Letter knowledge
Two lists of the letters of the alphabet printed in clear lower case font were assembled for each language. The letters were displayed in vertical columns on A4 sheets.

Familiar words
Sets of very familiar high frequency words were sampled from the reading materials used in the early stage of primary schooling in each language. Two sets were compiled: (1) two lists of content words (principally imageable nouns), and (2) two lists of function words (grammatical morphemes). Each set was presented as two separate lists of nine items vertically arranged on A4 sheets. The items selected for the deeper orthographies were permitted to contain orthographically complex features (diacritics, multi-letter graphemes, irregularities).

Simple nonwords
Two sets of nonwords were constructed for each language, one consisting of monosyllables and using the structures CV, VC and CVC, and the other of bisyllables formed from the structures VCV, CVCV and VCVC. Two separate lists were prepared for both lengths, each containing nine items vertically arranged on A4 sheets. The nonwords were formed by sampling dominant and consistent grapheme–phoneme (1 letter, 1 sound) correspondences in each language and included no complex structures.[2]

Procedure
Each of the three reading tasks was introduced by presentation of six practice items and an explanation. For letters, children were asked to pronounce the names or sounds (depending which was emphasized by the local educational system) of each item. For familiar words, they were asked to read out each item on the list. In the case of nonwords, they were told that the items were made-up words which they might, nonetheless, be able to pronounce.

The lists were presented in a fixed sequence (letters, familiar words, nonwords). Testing was carried out individually. Vocal responses in reading the complete sequence of nine items on each list were tape recorded for subsequent checking and categorization. A stop watch was started when the list was presented to the child and stopped when the last item had been attempted. If a child was blocked by a particular item he or she was encouraged to move on and complete the list.

Participants
Foundation literacy acquisition in English was tested in two groups of children attending primary schools in the city of Dundee on the east coast of Scotland. Children in Group 1 attended a school located in a predominantly middle class (high SES) area of the city. The sample included Primary 1 children aged 5 years and Primary 2 children aged 6 years.

[2] The construction of nonwords for use in cross-language comparisons is problematic in the light of differences in syllable structure. The COST A8 group debated the relative merits of adopting 'natural' but differing structures for each language as opposed to a common set of structures, some of which might appear 'unwordlike' for some subsets of languages. Eventually, the use of a common set of patterns was adopted as consonant with the primitive (non-lexicalized) model of decoding postulated in the foundation literacy framework. Further research to determine how far the use of natural versus unnatural CV structures influences the development of decoding at this early phase would be of interest.

Group 2 was drawn from a school located in a socially disadvantaged (low SES) area of the city. Primary 3 children, aged 7 years, were tested in addition to P1 and P2 groups. Reading ages were determined for the high SES sample by applying the word recognition subtest of the British Abilities Scale (BAS) (Elliot, 1987).

A comparison of the P1 and P2 results confirmed that there was a large advantage in reading accuracy for the high SES group over the low SES group, with $F(1, 116) = 18.14$, $p < .001$ for letters, $F(1, 233) = 43.05$, $p < .001$ for familiar content and function words, and $F(1, 233) = 16.15$, $p < .001$ for monosyllabic and bisyllabic nonwords. However, differences between the high SES P1 and P2 groups and the low SES P2 and P3 groups were not significant. These results agree with previous indications that low SES is associated with a delay in letter-sound acquisition and a consequent lag of about 1 year in the development of the logographic and alphabetic foundation processes (Duncan & Seymour, 2000).

Given this effect, we will restrict the comparison between English and the other European orthographies to the high SES Scottish group. Table 2 provides details of the P1 and P2 sample sizes, and the chronological ages and BAS reading ages at the time of testing. Both groups were reading well ahead of age expectation. The comparison between English and other orthographies is based on a sample of children who are not held back by social disadvantage and who are making excellent progress according to UK norms.

Table 2 identifies the simple syllable and complex syllable European orthographies and shows the sample sizes and average ages at the time of testing.[3] Samples were recruited from effective schools in non-deprived areas in each country. The participants were enrolled in Grade 1 (P1) classes and were tested in the latter part of their first school year. In addition, Grade 2 (P2) groups participated in France and Denmark as well as in Scotland.

Age and gender

The mean ages of the samples varied in line with national differences in the age of commencement of formal schooling. The Scottish P1 children entered school at 5 years and were younger than any other group. The groups learning to read complex syllable languages were slightly older than the groups learning simple syllable languages (89 vs. 85 months, $F(1, 531) = 57.83$, $p < .001$). Within the simple syllable set, the Finnish group, aged 94 months, was differentiated from all other groups, 80–84 months, $F(5, 247) = 126.70$, $p < .001$. There were also differences between the complex syllable languages, with the main group averaging 82–91 months and the Norwegian children significantly older at 95 months ($F(6, 273) = 38.03$, $p < .001$).

The relationship between chronological age and performance on the foundation literacy tasks was determined in a correlational analysis. Table 3 gives the values of Pearson r between the ages of all Grade 1 children at the time of testing and the accuracy and time scores for reading letters, familiar words and simple nonwords. The correlations were calculated with and without inclusion of the Scottish P1 sample. With the

[3] *There were some instances of incomplete returns of data. Time scores were missing for two children in the Danish P1 sample and chronological ages for four children in the Finnish sample. The most serious problems arose with the French dataset: Time scores were omitted for 31 P1 cases and 8 P2 cases and chronological ages were not given for 18 P1 cases and 21 P2 cases. In the analyses we have used the maximum available sample (see df values in the ANOVAs).*

Table 2. Simple syllable and complex syllable European orthographies, sample sizes and average ages at the time of testing

		Country	Grade	*N*	Age (years)
Simple syllable structures	Shallow	Finnish	1	70	7.87 (.28)
	.	Greek	1	44	6.75 (.27)
	.	Italian	1	38	6.89 (.31)
	.	Spanish	1	40	6.84 (.27)
	.	Portuguese	1	38	7.01 (.32)
	.	French	1	45	6.69 (.32)
	Deep	French	2	29	7.94 (.56)
Complex syllable structures	Shallow	Austrian	1	57	7.55 (.41)
	.	German	1	28	7.40 (.34)
	.	Norwegian	1	40	7.94 (.28)
	.	Icelandic	1	37	6.86 (.25)
	.	Swedish	1	25	7.48 (.59)
	.	Dutch	1	28	6.97 (.36)
	.	Danish	1	65	7.65 (.38)
	.	Danish	2	40	8.55 (.34)
	.	Scottish	1	30	CA 5.59 (.32)
	.				RA 6.19 (.63)
	.	Scottish	2	30	CA 6.56 (.30)
	Deep				RA 7.22 (.84)

Note. Participants were enrolled in Grade 1 (P1) classes and were tested in the latter part of their first school year. Grade 2 (P2) groups also participated in France, Denmark and Scotland.

Scottish data excluded, the overall indication is that foundation literacy is not strongly related to age. Nonword reading was independent of age and the relationships with letter accuracy and word reading speed, although significant, are very weak. Inclusion of the results for the younger Scottish children increases the strength of the correlations with age quite substantially, especially for performance on the word reading task.

Table 3. Pearson *r* between the ages of all Grade 1 children at the time of testing and the accuracy and time scores for reading letters, familiar words and simple nonwords

	Excluding Scottish P1	Including Scottish P1
Letter accuracy	.110*	.120**
Letter time/item	.015	−.189**
Word accuracy	−.018	.339**
Word time/item	−.125**	−.375**
Nonword accuracy	−.019	.289**
Nonword time/item	−.020	−.261**

$^{*}p < .05$; $^{**}p < .01$.

Note. Correlations were calculated with and without inclusion of the Scottish P1 sample.

There was an equal balance of male and female participants. Tests were made of the effects of gender on each of the foundation literacy measures but no significant differences were obtained (F usually < 1).

Conclusions

This preliminary analysis indicates that foundation literacy acquisition by non-English European groups is not affected by gender and is largely independent of variations in the ages at which children commence formal schooling.

STUDY 1: LETTER-SOUND KNOWLEDGE

Table 4 reports the accuracy (per cent correct) and speed (s/item) of letter identification by each language group. A three-step analysis of the data was followed: (1) results for simple syllable and complex syllable languages (Scottish excluded) were compared in order to determine whether syllabic complexity influenced letter-sound learning; (2) results for the individual languages within the simple and complex series were contrasted in order to test for an effect of orthographic depth; (3) the Scottish data were compared with the other languages as a test of a special difficulty in English.

Table 4. Accuracy (per cent correct) and speed (seconds per item) of letter identification by each language group (standard deviations in parentheses)

			Letter-sound identification	
			%	s/item
Simple syllable structures	Shallow	Finnish	94.44 (4.71)	1.48 (0.55)
	.	Greek	96.40 (5.09)	1.05 (0.27)
	.	Italian	95.13 (7.67)	1.06 (0.46)
	.	Spanish	95.55 (4.99)	1.03 (0.44)
	.	Portuguese	92.48 (7.84)	1.40 (0.50)
	.	French P1	91.22 (10.83)	1.38 (0.61)
	Deep	French P2	98.03 (4.32)	1.26 (0.18)
Complex syllable structures	Shallow	Austrian	96.85 (3.32)	0.74 (0.16)
	.	German	99.51 (1.79)	0.75 (0.19)
	.	Norwegian	98.65 (2.46)	0.84 (0.22)
	.	Icelandic	95.73 (5.33)	1.02 (0.24)
	.	Swedish	98.74 (1.75)	1.36 (0.37)
	.	Dutch	89.51 (4.66)	0.94 (0.27)
	.	Danish P1	94.92 (7.30)	1.14 (0.51)
	.	Danish P2	97.95 (2.42)	0.63 (0.17)
	.	Scottish P1	93.97 (6.03)	1.88 (1.01)
	Deep	Scottish P2	96.03 (4.68)	1.03 (0.27)

Accuracy

An analysis of variance was conducted to compare languages with simple syllabic structure against languages with complex syllabic structure (Grade 1 groups only). The hypothesis that letter learning might be delayed in complex syllable languages was not supported. Accuracy was slightly higher in complex than in simple syllable languages (96% vs. 94%), $F(1, 553) = 13.84$, $p < .001$.

Further analyses were conducted to test for differences between languages within each series. There was a variation between 91 and 96% among the simple syllable languages, $F(5, 269) = 3.4$, $p < .01$, with French and Portuguese at the lower end and Spanish and Greek at the higher end. The variation among complex syllable languages was slightly wider (89–99%), $F(6, 273) = 15.85$, $p < .001$, with Dutch picked out as the language with the lowest accuracy level.

The outcome for the Scottish P1 group was then compared with the results for all other languages. The language effect was significant, $F(13, 571) = 7.65$, $p < .001$, but this was not attributable to an outlying result for English. *Post hoc* tests identified four overlapping sets of scores. The Scottish result (94%) was embedded in the main series and was better than Dutch, French or Portuguese.

Speed

Table 4 gives information about the speed of letter identification in each language. The preliminary analysis (with English excluded) suggested that letter identification was slower (1.24 s/item) in simple than in complex syllable (0.96 s/item) languages, $F(1, 522) = 52.01$, $p < .001$. This effect is again in the wrong direction with respect to the syllabic complexity hypothesis.

There were inter-language differences within the simple syllable series, $F(5, 238) = 8.64$, $p < .001$, and within the complex syllable series, $F(6, 273) = 17.24$, $p < .001$. *Post hoc* (Scheffe) tests identified French, Portuguese and Finnish as the slower subgroup in the first series, and Danish and Swedish in the second series. Naming time per letter was slower in the Scottish P1 group (1.88 s/item) than in any other language. An analysis of variance indicated that this effect was significant in relation to the complex syllable languages, where $F(7, 302) = 25.19$, $p < .001$, and *post hoc* tests differentiated the Scottish outcome from Swedish (1.36 s/item).

Conclusions

There are variations between languages in the efficiency of letter-sound acquisition during the first school year. However, all groups achieve a mastery level of 90% or better on average and there is no strong support for the conclusion that learning is affected by the linguistic factors of syllabic complexity or orthographic depth. In particular, the complexity of the English orthography did not appear to have delayed the acquisition of letter-sound knowledge in the high SES Scottish P1 sample.

There were differences in speed of letter identification. Most groups demonstrated a high level of fluency, quantifiable as a rate of about 1 s/item, but speeds were slightly slower in some languages. Again, the variations were not obviously attributable to contrasts in syllabic complexity or orthographic depth. There was no general association between fluency and chronological age in European groups aged 6 years and above. However, naming speed was slower in the Scottish P1 sample than in any other language. This dysfluency could be an effect of immaturity in Scottish children who commence formal learning at an earlier age (5 years) than any of the other language groups.

STUDY 2: FAMILIAR WORDS

Table 5 summarizes the accuracy and time data for reading lists of very familiar words. Overall, the accuracy level was 90% (Scottish data excluded). An analysis of variance indicated that there was no general difference between content and function words, $F(1, 1107) < 1$. The distinction affected reading speed, with content words somewhat slower than function words (2.02 s/item vs. 1.7 s/item), $F(1, 1043) = 6.79$, $p < .01$, probably due to length differences between the two sets of items. Results for the two word sets were combined in the subsequent analyses which followed the same three-step approach as was adopted for the letters.

Accuracy

A preliminary analysis was carried out on the European data with English excluded. Ranges within the simple and complex syllable languages were similar (74–98% for simple, 71–98% for complex) and the overall difference between the series was not significant, $F(1, 553) < 1$.

There was a large variation among the simple syllable languages, $F(5, 269) = 25.62$, $p < .001$. This effect occurred because accuracy in French and Portuguese (< 80%) was significantly lower according to Scheffe *post hoc* tests than in any of the other languages (> 90%). The variation was also significant in the complex syllable languages, $F(6, 273) = 21.94$, $p < .001$, due to the low accuracy in Danish (71%).

Word reading accuracy by the Scottish P1 sample (34%) fell far below the range of the other languages. Language differences with Scottish included were highly significant, $F(13, 571) = 47.99$, $p < .001$. According to *post hoc* Scheffe tests, the Scottish P1 mean was significantly below the results for Danish, Portuguese and French, which were, in turn, differentiated from the outcomes for all remaining languages. The Scottish P2 results formed a subset with Danish, Portuguese and French (< 80% accuracy).

These data suggest that competence in familiar word reading approaches mastery much more slowly in English than in other European orthographies. At the end of the first school year, accuracy is typically > 90% in the majority of languages and > 70% in the deeper orthographies. Danish children require an additional year to exceed the 90% threshold. English-speaking children remain well below this level even after two years of learning.

An alternative way of expressing this trend is to consider the relationship with reading age. Within the Scottish sample overall (P1 and P2 combined), there was a strong association between BAS reading age and accuracy of familiar word reading, with $r = +.86$, $p < .01$. The test for a linear trend in the data was highly significant, $F(1, 59) = 397.22$, $p < .001$. The function relating the two variables had a slope of 2.49 percentage points accuracy for each month of reading age. On this basis, it was possible to calculate that the Scottish group crosses a 90% threshold at a reading age of nearly 8 years. However, the sample included a few children ($N = 5$) who had very high reading ages (> 96 months). The presence of these cases reduces the slope of the regression line and increases the reading age at which the threshold is crossed. A reanalysis with the advanced readers excluded produced the function graphed in Fig. 2. This shows the scatter of the data and the regression line for word naming accuracy against reading age. The 90% threshold is crossed at a reading age of 7 years 4 months.

Table 5. Accuracy (per cent correct) and time (seconds per item) data (standard deviations in parentheses) for reading lists of very familiar words, with outcomes for content, function and combined content and function words for each language group

			Familiar word reading					
			Content words		Function words		Combined content/function	
			%	s/item	%	s/item	%	s/item
Simple syllable structures	Shallow	Finnish	98.17 (4.09)	1.38 (0.91)	98.41 (3.43)	1.13 (0.72)	98.29 (3.76)	1.25 (0.83)
	.	Greek	96.59 (5.90)	1.60 (0.63)	98.61 (2.97)	1.31 (0.67)	97.60 (4.75)	1.45 (0.66)
	.	Italian	94.88 (17.54)	2.18 (1.18)	95.76 (16.61)	1.23 (0.58)	95.32 (16.97)	1.70 (1.04)
	.	Spanish	94.17 (10.29)	1.40 (1.23)	95.28 (9.71)	1.31 (1.00)	94.72 (9.96)	1.35 (1.11)
	.	Portuguese	77.19 (19.45)	3.44 (2.44)	69.88 (20.77)	3.00 (1.81)	73.54 (20.32)	3.22 (2.14)
	.	French P1	72.47 (27.57)	7.04 (10.87)	85.68 (20.87)	4.19 (6.74)	79.07 (23.54)	5.61 (9.00)
	Deep	French P2	98.47 (4.67)	1.00 (0.29)	100.00 (0.00)	0.64 (0.21)	99.23 (2.45)	0.84 (0.26)
Complex syllable structures	Shallow	Austrian	97.08 (4.94)	1.34 (0.64)	97.86 (4.42)	0.82 (0.29)	97.47 (4.68)	1.08 (0.56)
	.	German	97.42 (4.90)	1.35 (0.74)	98.02 (3.77)	0.76 (0.39)	97.72 (4.34)	1.06 (0.66)
	.	Norwegian	91.53 (16.55)	2.13 (1.39)	92.08 (14.23)	1.71 (1.19)	91.81 (15.34)	1.92 (1.30)
	.	Icelandic	93.39 (9.15)	2.36 (1.65)	94.74 (8.58)	1.88 (1.21)	94.07 (8.84)	2.12 (1.46)
	.	Swedish	93.56 (9.31)	2.64 (2.57)	96.67 (4.81)	1.39 (1.22)	95.11 (7.50)	2.01 (2.09)
	.	Dutch	92.66 (7.10)	2.02 (0.84)	98.21 (5.03)	1.17 (0.67)	95.44 (6.71)	1.60 (0.87)
	.	Danish P1	70.94 (26.78)	1.15 (1.03)	71.20 (29.93)	2.51 (2.00)	71.07 (27.71)	1.85 (1.42)
	.	Danish P2	92.22 (13.88)	1.18 (1.40)	92.92 (10.45)	0.91 (0.82)	92.57 (11.74)	1.05 (1.09)
	.	Scottish P1	32.59 (24.83)	8.19 (6.08)	35.18 (26.23)	7.36 (6.43)	33.89 (24.97)	7.78 (6.19)
	Deep	Scottish P2	79.07 (18.32)	2.11 (1.40)	73.70 (21.34)	2.25 (1.59)	76.39 (19.27)	2.18 (1.41)

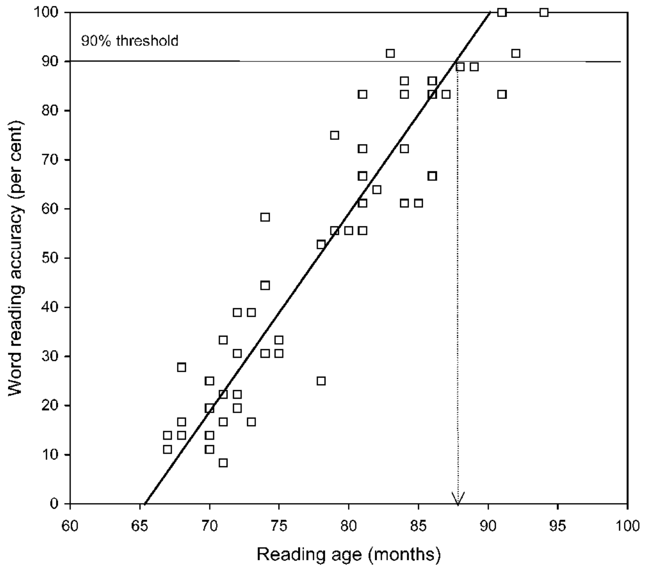

Figure 2. European mastery thresholds and regression of familiar word reading accuracy (per cent) against BAS reading age (months) for the Scottish P1 and P2 sample.

Speed

Table 5 reports the reading times for the familiar word lists. Reading speeds in simple and complex syllable languages (1.93 vs. 1.65 s/item) did not differ, $F(1, 522) = 2.68$, *ns*. There were variations between languages in both series, where $F(5, 238) = 11.38$, $p < .001$, for the simple set, and $F(6, 273) = 5.41$, $p < .001$, for the complex set. *Post hoc* (Scheffe) tests differentiated French (5.61 s/item) from other simple syllable languages and placed Portuguese (3.22 s/item) at the outer edge of the remaining languages. There were two overlapping sets among the complex syllable languages and no clear instances of slow reading. The Danish data (1.85 s/item) fell well within the boundaries of the remainder of the series.

The reading speed of the Scottish P1 group (7.78 s/item) was substantially slower than that of any other group. There was a significant variation across the full set of languages, $F(13, 540) = 20.63$, $p < .001$, which was interpretable, according to the *post hoc* tests, in terms of a main subset of languages, mostly <2 s/item, a Portuguese and French subgroup, and Scottish P1 as an isolated outlier. Reading speed for the Scottish P2 group (2.18 s/item) was close to the range of the main set of languages.

According to these results, fluency may be defined operationally as a speed of <2.25 s/item on the word list reading task. This is achieved in most languages before the end of the first school year. In the Scottish sample, word reading speed was associated with BAS reading age, $r = -.614$; $p < .01$, by a strongly linear relationship, $F(1, 59) = 39.14$, $p < .001$. A plot of this relationship is shown in Fig. 3. The data for the five advanced readers have been excluded. It can be seen that the Scottish group passes a fluency threshold of 2.25 s/item after a reading age of about 7 years is exceeded.

Conclusions

There are substantial variations among European language groups in facility for identifying and reading familiar words. These differences do not appear to relate to

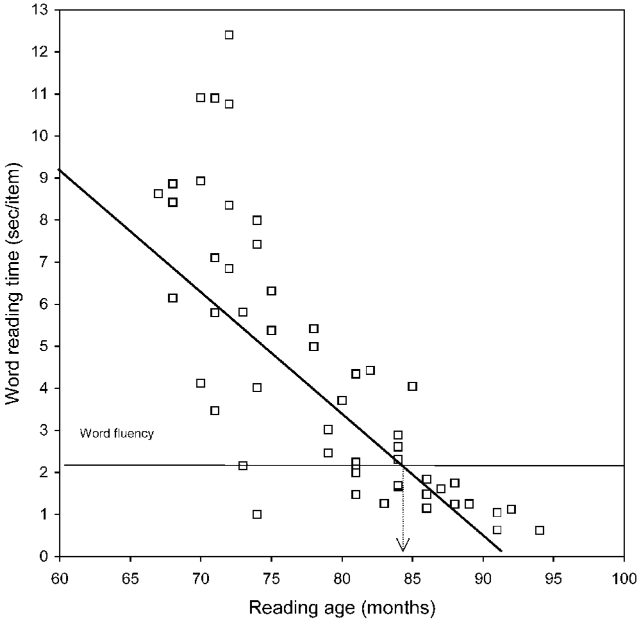

Figure 3. European fluency threshold and regression of familiar word reading speed (s/item) against BAS reading age (months) for the Scottish P1 and P2 sample.

the contrast between languages with simple and complex syllabic structure. However, there is good evidence of an effect of orthographic depth. Within the simple series, French and Portuguese were associated with large reductions in accuracy and speed. Among the complex syllable languages, Danish showed a relative reduction in accuracy although this did not affect fluency. French, Portuguese and Danish were identified as the deeper European orthographies (see Table 1).

The most striking feature is the relative delay in achievement of efficient reading of familiar words by the English-speaking sample. In particular, the performance of the P1 Scottish group fell far below the levels of first-year groups in other countries. The delay was quantified in terms of rates of gain in accuracy and speed relative to BAS reading age. The results suggest that a reading age in excess of 7 years is needed before performance converges on the levels which are typical for the first year of learning in the majority of European orthographies.

STUDY 3: SIMPLE NONWORDS

The third study tested capacity to decode simple mono- and bisyllabic nonwords. The accuracy and time data have been summarized in Table 6. Monosyllables were read more accurately than bisyllables, 89 versus 81%, $F(1, 1107) = 43.35$, $p < .001$, and at higher speed, 1.88 versus 2.94 s/item, $F(1, 1042) = 66.03$, $p < .001$.

Accuracy

The preliminary analyses were conducted using the overall scores for nonword decoding (mono- and bisyllables combined) on the Grade 1 samples, Scottish data excluded. In line with the complexity hypothesis, nonword reading was more accurate

Table 6. Accuracy (per cent correct) and time (seconds per item) data for reading lists of simple nonwords, with outcomes for monosyllabic, bisyllabic and combined syllable lengths (standard deviations in parentheses) for each language group

			Simple nonword reading					
			Monosyllabic nonwords		Bisyllabic nonwords		Combined nonwords	
			%	s/item	%	s/item	%	s/item
Simple syllable structures	Shallow	Finnish	97.62 (4.78)	1.08 (0.66)	92.46 (8.92)	1.81 (1.08)	95.04 (5.77)	1.44 (0.86)
	.	Greek	96.84 (5.14)	1.32 (0.53)	87.25 (10.28)	1.97 (0.69)	92.05 (6.90)	1.64 (0.60)
	.	Italian	92.11 (19.36)	1.58 (0.68)	86.70 (20.85)	2.41 (0.93)	89.40 (19.54)	1.99 (0.77)
	.	Spanish	93.06 (10.28)	0.96 (0.54)	84.58 (14.48)	2.03 (1.74)	88.82 (11.78)	1.50 (1.12)
	.	Portuguese	76.32 (21.87)	2.24 (1.27)	77.49 (19.63)	3.70 (2.29)	76.90 (19.45)	2.97 (1.73)
	.	French P1	88.27 (18.43)	3.09 (2.48)	81.60 (23.83)	5.17 (5.18)	84.94 (20.61)	4.13 (3.79)
	Deep	French P2	99.23 (2.45)	0.86 (0.20)	95.59 (11.05)	1.01 (0.22)	97.42 (6.38)	0.94 (0.18)
Complex syllable structures	Shallow	Austrian	97.17 (3.95)	1.16 (0.39)	86.65 (11.15)	1.97 (0.66)	91.91 (6.54)	1.57 (0.51)
	.	German	97.82 (3.15)	1.10 (0.48)	90.87 (8.03)	1.80 (0.67)	94.35 (4.99)	1.45 (0.56)
	.	Norwegian	93.33 (9.84)	1.95 (1.11)	88.19 (20.60)	2.86 (1.52)	90.76 (14.86)	2.40 (1.30)
	.	Icelandic	91.29 (10.92)	1.84 (1.14)	81.68 (16.40)	2.79 (1.52)	86.49 (11.60)	2.31 (1.32)
	.	Swedish	90.89 (8.91)	2.37 (1.96)	84.44 (11.56)	3.86 (3.84)	87.67 (8.97)	3.11 (2.88)
	.	Dutch	90.48 (10.99)	2.65 (0.99)	74.01 (24.10)	4.68 (2.17)	82.24 (16.72)	3.67 (1.50)
	.	Danish P1	62.56 (31.26)	3.86 (2.84)	44.87 (36.09)	5.18 (3.94)	53.72 (31.82)	4.58 (3.19)
	.	Danish P2	87.50 (15.14)	1.75 (1.93)	75.00 (25.44)	2.93 (3.13)	81.25 (19.14)	2.34 (2.51)
	.	Scottish P1	40.56 (36.65)	6.04 (3.42)	17.96 (26.37)	7.35 (4.61)	29.26 (29.40)	6.69 (3.87)
	Deep	Scottish P2	74.26 (22.67)	2.47 (1.43)	52.78 (33.48)	3.87 (2.40)	63.52 (25.53)	3.17 (1.77)

in simple syllable languages than in complex syllable languages, 88.71 versus 81.06%, $F(1, 553) = 20.18, p < .001$. It seemed possible that the effect might be contingent on the presence of the deeper orthographies in each series. To guard against this, the analysis was repeated with French, Portuguese and Danish removed. The effect was preserved (91.94% for simple languages, 89.32% for complex) and remained significant, $F(1, 405) = 5.18; p < .05$.

There were differences among the simple syllable languages, $F(5, 269) = 8.8$, $p < .001$. *Post hoc* Scheffe tests differentiated Portuguese and French from the other languages (>85% correct). Differences among complex syllable languages were also significant, $F(6, 273) = 33.19$, $p < .001$. The *post hoc* tests separated Danish (53.72%) from the remainder of the series (82–94%).

Accuracy in the Scottish P1 sample (29.26%) was again far below the range for the other orthographies. The analysis of variance of all languages indicated highly significant differences, $F(13, 571) = 43.7$, $p < .001$, which were resolvable into three groups, Scottish P1, Danish, and the remaining languages, including French and Portuguese. The Scottish P2 group, at 63.5% correct, was also below all Grade1 samples other than Danish and was grouped with Danish in the *post hoc* tests. The Danish P2 group (81.25%) was close to the lower boundary of the main set of European languages.

It is again possible to estimate the amount of experience required to achieve mastery of simple decoding in English by examining the relationship between nonword reading accuracy and BAS reading age. In the Scottish P1 and P2 samples accuracy was strongly associated with reading age, $r = +.645, p < .01$. A European Grade 1 mastery level can be approximated at 85+ % for the majority of languages. The Scottish group gained approximately 2.18% in nonword reading accuracy for each additional month of reading age. According to this function, the 85% threshold is not passed until reading age exceeds 8 years 2 months.

As in the analysis of familiar word data, it seemed possible that the presence of a few advanced readers in the Scottish sample might lower the slope of the gain function and raise the estimates of the reading ages required to pass the European threshold. Also, as already noted, monosyllabic nonwords were read more accurately than bisyllables. Excluding Danish, Portuguese and French, monosyllables were read with better than 90% accuracy in all languages, and bisyllables with better than 80% accuracy. Decoding two- and three-letter monosyllables represents the most simple and basic level of decoding skill imaginable, whereas decoding of bisyllables, requiring coordination of sequences of three or four grapheme-phoneme correspondences, is more complex and demanding. It seemed worthwhile, therefore, to examine the gain in competence in the Scottish group for these two levels of decoding skill with the advanced readers excluded.

Over the sample as a whole (P1 and P2), correlations with reading age were $r = .645$; $p < .01$ for accuracy in reading monosyllables, and $r = .710$; $p < .01$ for accuracy in reading bisyllables. The gain functions for mono- and bisyllabic nonword reading accuracy are plotted against BAS reading age in Fig. 4. There is a strong linear trend in both sets of data and a slope of approximately 2.9 percentage points per month of reading age. The data show that Scottish children cross the threshold for simple decoding (monosyllables) when reading age surpasses 7.5 years. The threshold for complex decoding (bisyllables) is passed when reading age exceeds 8 years. A comparable analysis of the Danish data, using chronological age as the index, indicated that the thresholds were crossed at just under 9 years of age.

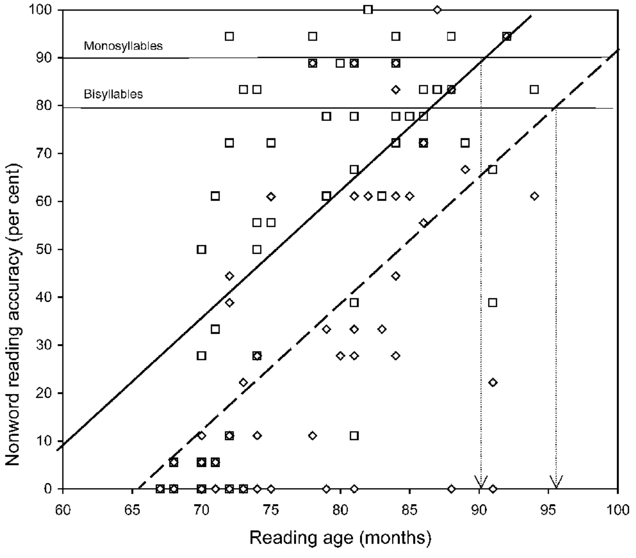

Figure 4. European mastery thresholds and regression of accuracy (per cent) in reading simple monosyllabic (□/——) and bisyllabic (◇/– – –) nonwords against BAS reading age (months) for the Scottish P1 and P2 sample.

Speed

Table 6 gives the reading speeds for the mono- and bisyllabic nonword lists. These data were initially submitted to a general analysis with monosyllables and bisyllables combined and the Scottish results excluded. The main effect of syllabic structure was significant, $F(1,521)= 24.38$, $p<.001$. Average reading speed was faster in the simple syllable languages than in the complex syllable languages (1.97 s/item vs. 2.81 s/item). The analysis was repeated without the results for Danish, Portuguese and French. A significant difference, $F(1,409)= 17.97$; $p<.001$, in favour of simple syllable languages remained (1.68 vs. 2.29 s/item).

There were differences between languages within both series ($F(5,238)= 14.92$, $p<.001$, for the simple series; $F(6,272)= 16.29$, $p<.001$, for the complex series). *Post hoc* tests (Scheffe) differentiated French (4.13 s/item) from other simple syllable languages and placed Portuguese (2.97 s/item) with Italian in a middle subset. The complex syllable languages fell into three overlapping sets, with Danish (4.58 s/item) at the outer edge of the slowest group together with Dutch and Swedish.

The Scottish P1 nonword reading speed (6.69 s/item) was slower than that of any other language. Comparison with the results for the other complex syllable languages gave a significant main effect, $F(7,301)= 22.74$, $p<.001$, and separated the Scottish mean from all other languages in the series. Reading speed in the Scottish P2 group was 3.17 s/item, close to the outcomes for Portuguese and French in the simple syllable set, and Swedish, Dutch and Danish in the complex syllable set. Danish P2 children read nonwords at 2.34 s/item, within the range of the faster complex syllable languages.

A further analysis was undertaken in order to determine the requirement, in terms of reading age, for the achievement of fluency in nonword reading by the Scottish P1 and P2 sample. Simple decoding (monosyllables) and complex decoding (bisyllables) were treated separately. The mean speed of monosyllable reading for languages other than Portuguese, French and Danish, was 1.5 s/item. A preponderance of times were below

2 s/item, the exceptions being Dutch (2.65 s/item) and Swedish (2.37 s/item). We will treat 2 s/item as our best estimate of fluent reading of 2–3 letter monosyllables. For bisyllables, the mean speed without Portuguese, French and Danish was 2.4 s/item. All values were below 3 s/item except for Swedish (3.86 s/item) and Dutch (4.68 s/item). There is evidence, therefore, of a general slowness of decoding in these two complex syllable languages. We will adopt 3 s/item as a liberal estimate of the boundary for fluent reading of 3–4 letter bisyllables.

In the Scottish sample, nonword reading speed (s/item) correlated with reading age at $r = -.645$; $p < .01$ for monosyllables and $r = -.556$; $p < .01$ for bisyllables. Following omission of the results for the advanced readers, the gain in fluency was – .208 s/item per month of reading age for monosyllables, and – .177 s/item for bisyllables. Both functions were strongly linear, $F(1, 51) = 48.46$ and 20.48, $p < .001$. They are plotted in Fig. 5 against the European fluency thresholds for monosyllables and bisyllables. It can be seen that the Scottish data pass the threshold for monosyllables when reading age exceeds 7 years 4 months, and for bisyllables when reading age exceeds 7 years 7 months.

Conclusions

The results demonstrate that the capacity to develop simple nonword decoding skills varies substantially between orthographies. There was evidence that these skills might be more difficult to establish in the context of complex syllable languages than in the context of simple syllable languages. Nonwords were read more accurately and more rapidly by simple syllable than by complex syllable samples. There was also evidence of orthographic depth effects paralleling those found for familiar words. Reductions in

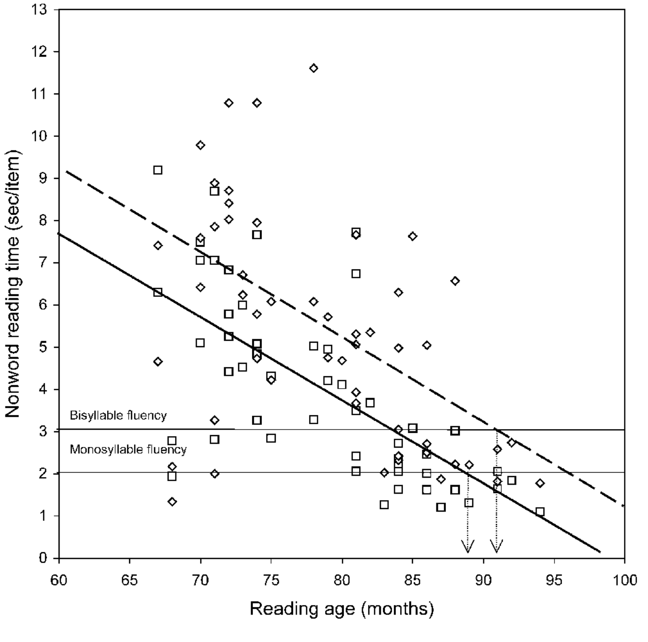

Figure 5. European fluency thresholds and regression of reading speed (s/item) for monosyllabic (□/——) and bisyllabic (◇/– – –) nonwords against BAS reading age (months) for the Scottish P1 and P2 sample.

accuracy and fluency were apparent in French and Portuguese among the simple syllable languages, and in Danish, and, to a lesser extent, Swedish and Dutch, among the complex syllable languages.

The most striking outcome was the evidence of profound delays in the development of simple decoding skills in English. The performance of the Scottish P1 sample fell far below the range for all other groups. Quantification of this effect, using the regression method, suggested that a reading age of 7.5 years or above was necessary before accuracy and fluency matched the European levels.

Lexicality effects

The 'lexicality effect' is the processing advantage, in terms of error rates and reading speed, for familiar words over unfamiliar nonwords. Additional analyses were made of the composite word and nonword scores from studies 2 and 3 in order to test for this effect in the European orthographies.

The first analysis contrasted word and nonword accuracy in the simple and complex syllable languages (Scottish excluded). A summary of the data appears in Fig. 6. Both groups of languages show a lexicality effect (word advantage) but this is smaller in the simple syllable languages (1.97 percentage points) than in the complex syllable languages (8.63 percentage points). The analysis of variance confirmed an overall advantage for simple syllable languages, $F(1, 1106) = 14.6$, $p < .001$, an effect of lexicality, $F(1, 1106) = 21.93$, $p < .001$, and syllable × lexicality interaction, $F(1, 1106) = 8.66$, $p < .01$. The interaction is interpreted as the consequence of the difference in magnitude of the lexicality effect in the two sets of languages.

The fluency scores (s/item) were also analysed. Reading was slower in complex syllable languages, $F(1, 1043) = 5.37$, $p < .05$. There was a lexicality effect, $F(1, 1043) = 24.10$, $p < .001$, and a strong interaction between the two factors, $F(1, 1043) = 21.54$, $p < .001$. Again, the interaction is taken to indicate an exaggeration of the lexicality effect in the complex syllable languages (1.17 s/item) relative to the simple syllable languages (0.03 s/item).

Table 7 reports the lexicality effects (word/nonword difference scores) on accuracy for each language individually. In the simple syllable set, these differences were all relatively small and reversed in two cases (French and Portuguese). Analysis of variance indicated significant effects of lexicality and language. There was a lexicality × language interaction, $F(5, 538) = 2.84$, $p < .05$, which was interpreted as reflecting the differences in the direction of the effect. Among complex syllable languages, the lexicality effects were all positive (words > nonwords) but varied in size, producing a language × lexicality interaction, $F(6, 546) = 2.73$, $p < .01$. A further analysis of the difference scores confirmed the presence of variations between languages, $F(6, 273) = 13.42$, $p < .001$. These were attributable according to *post hoc* tests to the large effects observed in Danish and Dutch. The effect was relatively smaller for the Scottish P1 sample but substantial for the Scottish P2 and Danish P2 samples.

The table also reports the sizes of the lexicality effects on fluency (s/item). The pattern is very similar to the outcomes for accuracy. The effect was small and not significant in simple syllable languages, $F(1, 476) < 1$. In complex syllable languages, there was a large effect, $F(1, 551) = 66.75$, $p < .001$, and a strong language × lexicality interaction, $F(6, 545) = 8.73$, $p < .001$, which was interpreted, following an analysis of difference scores, in terms of an exaggeration of the effect in Dutch and Danish. These effects on fluency were not clearly evident in the Scottish P1 or P2 data.

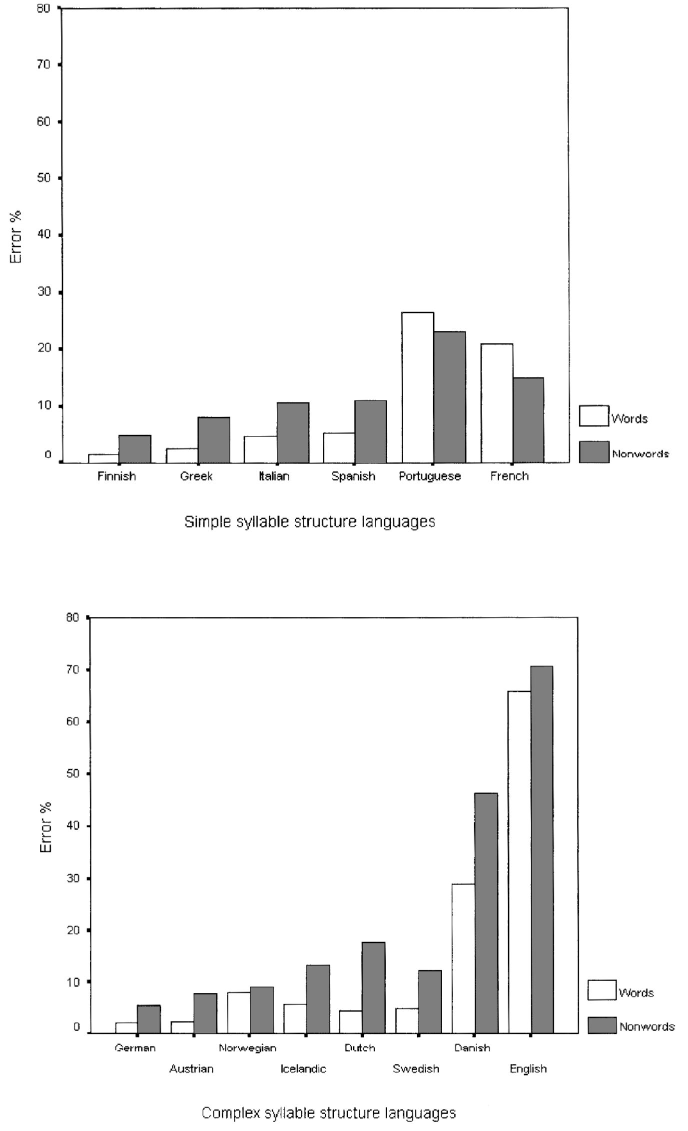

Figure 6. Error rates (per cent) for familiar word ▭ and simple nonword ▭ reading by simple syllable language groups and complex syllable language groups.

Conclusions

The results show that simple and complex syllable languages may be differentiated with respect to the size of the lexicality effect (the advantage for words over nonwords). The effect, for both accuracy and speed, was small in simple syllable languages but relatively large in complex syllable languages, and exaggerated in some cases (Danish and Dutch).

Error patterns

The error responses produced during the attempts on the word and nonword lists were classified as refusals, word substitutions, nonword substitutions, or letter soundings (see

Table 7. Lexicality effects (word/nonword difference scores) on accuracy (per cent correct) and time (seconds per item) for each language

			Lexicality effects	
			Word–nonword accuracy %	Nonword–word time (s/item)
Simple syllable structures	Shallow	Finnish	3.25 (5.37)	0.19 (0.31)
	.	Greek	5.56 (5.71)	0.19 (0.39)
	.	Italian	5.92 (8.20)	0.29 (0.46)
	.	Spanish	5.90 (8.21)	0.14 (0.43)
	.	Portuguese	– 3.36 (12.46)	– 0.26 (0.78)
	.	French P1	– 5.86 (15.99)	– 1.48 (5.47)
	Deep	French P2	1.83 (6.18)	0.13 (0.18)
Complex syllable structures	Shallow	Austrian	5.56 (5.22)	0.49 (0.22)
	.	German	3.37 (3.33)	0.39 (0.20)
	.	Norwegian	1.04 (4.90)	0.48 (0.39)
	.	Icelandic	7.58 (7.45)	0.19 (0.53)
	.	Swedish	7.44 (5.93)	1.10 (1.27)
	.	Dutch	13.19 (15.15)	2.07 (0.95)
	.	Danish P1	17.35 (17.43)	2.77 (2.35)
	.	Danish P2	11.32 (12.94)	1.29 (1.50)
	.	Scottish P1	4.63 (23.26)	– 1.08 (4.94)
	Deep	Scottish P2	12.87 (23.43)	0.99 (1.70)

Note. Lexicality effects reflect word minus nonword differences for accuracy and nonword minus word differences for time. Standard deviations are shown in parentheses.

Table 8). The incidence of refusals was very low in all languages other than Danish and English. The Scottish and Danish P1 samples exhibit a characteristic pattern in which word substitution errors predominate in responses to word targets while nonword substitutions predominate in responses to nonword targets. The Scottish children also produced a number of letter-sounding responses. The emphasis on word substitution is relatively stronger in the results for the French-speaking sample. All other groups, Portuguese included, show a bias towards alphabetic reading (preponderance of nonword substitutions) in the attempts at nonword reading.

Conclusions

Error patterns differed between languages. Primitive reactions, such as refusals or soundings of letters, were observed in the Scottish samples, and, to some extent, in Danish. Word substitution errors occurred in English, Danish, Portuguese and French in the attempts on word lists, and, in English and French, in the attempts on nonword lists. All groups, Scottish and Danish included, gave evidence of alphabetic processing through production of nonword error responses.

Individual variation

A striking feature of studies 2 and 3 (see Tables 5 and 6) is the differences in the variance of the accuracy and time scores of each language group. Standard deviations average

Table 8. Total percentage of errors produced in each sample for word and nonword targets and the proportions of error responses which can be classified as refusals, word substitutions, nonword substitutions, or letter soundings

			Word error patterns %					Nonword error patterns %				
		Language	Error	Refusals	Word subs	Nonword subs	Letter sounding	Error	Refusals	Word subs	Nonword subs	Letter sounding
Simple syllable structures	Shallow	Finnish	1.71	0.08	0.99	0.63	0.00	4.96	0.12	0.76	4.11	0.00
	.	Greek	2.40	0.06	1.77	0.51	0.06	7.95	0.25	1.58	6.12	0.00
	.	Italian	4.68	0.66	1.32	0.66	1.97	10.60	0.00	1.32	6.51	2.63
	.	Spanish	5.28	0.35	2.43	2.50	0.00	11.18	0.83	2.22	8.12	0.00
	.	Portuguese	26.46	1.75	10.23	12.06	2.41	23.10	0.66	4.53	14.69	3.22
	.	French P1	20.93	1.85	12.35	6.42	0.25	15.06	0.43	13.58	1.05	0.00
	Deep	French P2	0.77	0.00	0.48	0.29	0.00	2.59	0.87	0.29	1.05	0.38
Complex syllable structures	Shallow	Austrian	2.53	0.05	1.27	1.22	0.00	8.09	0.00	1.12	6.87	0.00
	.	German	2.28	0.00	1.39	0.89	0.00	5.65	0.10	0.60	4.96	0.00
	.	Norwegian	8.19	0.00	3.26	0.14	4.79	9.24	0.00	0.14	4.44	4.65
	.	Icelandic	4.56	0.40	3.37	0.40	0.40	17.76	0.40	1.19	10.32	5.85
	.	Swedish	5.93	0.60	2.48	1.43	1.43	13.51	0.08	2.70	3.00	7.81
	.	Dutch	4.89	0.00	2.11	2.33	0.44	12.33	0.89	2.00	9.00	0.56
	.	Danish P1	28.89	12.86	10.90	2.05	0.77	46.28	11.07	4.87	24.10	3.55
	.	Danish P2	7.43	0.97	6.32	0.07	0.14	18.75	0.97	2.64	14.93	0.00
	.	Scottish P1	66.11	24.07	16.94	7.31	17.78	70.74	15.00	13.61	19.17	23.06
	Deep	Scottish P2	23.61	9.72	10.00	2.22	1.67	36.48	4.91	9.91	14.54	7.04

8–10 percentage points and around 1 s/item for the main set of shallow orthographies but are greatly exaggerated in the deeper orthographies. To illustrate, Fig. 7 shows the 'normal' range for accuracy of word and nonword reading in shallow orthographies, defined as scores within the boundaries ±1.75 standard units from the mean of the combined distributions for all languages other than Portuguese, French, Danish and English (> 80%for words, > 70%for nonwords). The figure also shows a 'disability' range containing outlying data points. Some of these are quite extreme (beyond 5 standard units below the mean) but nonetheless exceed 40%correct for words and 25%correct for nonwords. There was only one instance of a 'non-reader', a child in the Italian sample who was unable to score on either the word or the nonword lists.

Figure 7 shows comparable data for the Portuguese and French samples and for the Danish and Scottish P2 samples. The statistics for the individual languages have been used to define a 'normal' range ±1.75 standard units from the mean. In most instances the normal range for these groups substantially overlaps the disability range for the shallow orthographies. The exceptions are Danish word reading, which has a tighter distribution, and Scottish nonword reading, where the dispersion is greatly exaggerated. Non-readers, defined as scores of < 10%accuracy in word or nonword reading, were rare (two cases in French, one in Scottish P2).

The figure also reports the variability of the Danish and Scottish P1 samples. The Danish P1 data for word reading are comparable to the outcomes for Portuguese, French and Scottish P2 and overlap the normal and disability ranges for the shallow orthographies. A displacement towards the lower end of the scale is apparent in Danish nonword reading and in the Scottish P1 results for words and nonwords. The normal

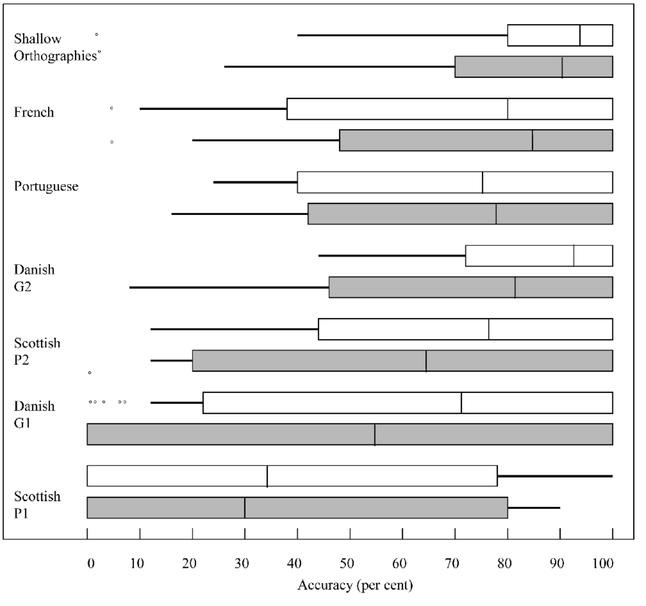

Figure 7. Dispersion of accuracy scores (per cent) for word ☐ and nonword ☐ reading by shallow orthography groups and by the French, Portuguese, Danish and Scottish samples. The figure indicates the range of scores falling within ±1.75 standard deviations of the mean for each distribution and the ranges for outlying scores. Non-readers (○) scoring less than 10% accuracy are also indicated.

range for these distributions approaches or extends into the non-reader zone. There were nine Danish children who were identifiable as non-readers. The Scottish P1 sample contained 12 children who were unable to read nonwords and who read only a few (<28%) words correctly. The set included one non-reader (8.3% for words, 2.78% for nonwords) and one classic instance of alphabetic dyslexia (83% correct for words, 6% for nonwords) (Seymour & Evans, 1999).

The Danish and Scottish P1 distributions include a 'precocity' zone above the normal range for these groups. Four Danish children were precocious readers according to this standard, all with 100% accuracy on words and 85–100% on nonwords. Another 10 scored above the criterion for nonword reading (>85%). The Scottish sample included three children with advanced scores for both words and nonwords (83 and 64%, 100 and 72%, 94 and 86%) as well as three instances of logographic dyslexia (31 vs. 69%, 33 vs. 67%, and 56 vs. 89% for words and nonwords respectively) (Seymour & Evans, 1999).

Conclusions

The task of learning to read a deep orthography generates a much wider variation in rate of initial progress than does the task of learning to read in a shallow orthography. Scores which reflect the normal variation in Portuguese, French, Danish and English fall within the disability range in the shallow orthographies. In English, and, to a lesser extent, in Danish, the normal range falls close to the non-reader range. Appreciable numbers of English and Danish children remain unable to read after several months in school although a few make rapid progress and read within the normal range for the shallow orthographies.

GENERAL DISCUSSION

The COST A8 cross-linguistic study demonstrates that the time needed to establish foundation literacy varies between European languages. The acquisition of elementary word recognition and decoding occurs more slowly in some languages (Portuguese, French, Danish) than in the majority, and the delay is greatly exaggerated in English. How are these cross-language effects to be explained?

One obvious hypothesis is that the effects are a product of the differences in the *ages* at which children start to learn to read. This could explain the slow progress made by the English-speaking sample in the P1 year. Five-year-old children may lack the maturity necessary for mastery of an alphabetic orthography. However, the Scottish P1 group learned the letters no less effectively than the other groups (study 1). It could be that the capacity to develop an explicit awareness of the phonemic structure of speech is the critical ability which is compromised by immaturity. However, Duncan, Seymour, and Hill (1997) tested explicit awareness of phonemes and other linguistic units in P1 classes in Dundee schools using a common unit identification task. Phonemic awareness developed rapidly and appeared not to be a limiting factor for a majority of children in P1. It is true that the Scottish group gave some evidence of dysfluency when reading lists of letters (study 1). Immaturity might curtail the achievement of automaticity in letter processing (LaBerge & Samuels, 1974) and this might slow down the formation of the logographic and alphabetic processes, both of which are dependent on letter-sound representations (Fig. 1).

In the wider context, the study suggests that the age of starting may not be an important factor. Correlations between age and performance on the foundation literacy tasks were weak or not significant (see Table 3). Difficulty in learning occurred despite a wide variation in starting age–5 years in the UK, 6 years in France and Portugal, and 7 years in Denmark. The comparison with Danish is instructive. Danish shares with English the features of a deep orthography and a complex syllable structure. In Denmark children do not enter primary school until they are 7 years old. Despite this 2-year age advantage, they experience difficulties in acquiring the logographic and alphabetic foundation processes which are comparable to those observed in English, although less extreme. Hence, although immaturity may contribute to the slow progress observed in English P1 classes, it seems unlikely that age is the major cause of the inter-language differences.

Another possibility is that differences in *teaching methods* may be responsible. In shallow orthographies, such as German, synthetic phonic methods are commonly used (Wimmer, 1993). Some commentators argue that rates of progress could be improved by using these same methods in English. However, this contention ignores the distinction between shallow and deep orthographies. In Scottish schools there is a preference for a mixed method which combines the teaching of a vocabulary of sight words with the teaching of the letters and decoding procedures (Duncan *et al.*, 1997). These methods are well adapted for deep orthographies in which commonly occurring words contain letter structures which are inconsistent with the principles of simple grapheme–phoneme correspondence.

The more interesting hypothesis is that fundamental linguistic differences are responsible. This hypothesis comes in two parts. The first states that languages whose phonology contains a complex syllable structure, defined in terms of a predominance of closed CVC syllables and the presence of numerous initial and final consonant clusters, create greater difficulties for beginning readers than do languages with a simple open syllabic structure. The second holds that acquisition occurs more rapidly in shallow orthographies, which are based on consistent one-to-one mappings between graphemes and phonemes, than in deep orthographies which include inconsistent bidirectional one-to-many mappings and lexical and morphological influences.

The *syllabic complexity* hypothesis was tested in the comparisons between simple syllable languages and complex syllable languages. The data support the conclusion that syllabic complexity exerts a selective effect on the development of the decoding process. This conclusion follows from the exaggeration of the lexicality effect and the reduced efficiency of nonword reading observed in the results of the complex syllable languages (study 3). The effect was not attributable to a general difference in efficiency. The complex syllable group was older than the simple syllable group and more accurate and faster in letter identification and labelling (study 1). The two groups were equivalent in accuracy and speed of familiar word reading (study 2). It is only in nonword reading that a significant disadvantage for the complex syllable group emerges.

It is important to emphasize that the syllabic complexity effect is evident when *simple* nonwords are read. The items used in study 3 were based on single letter grapheme–phoneme correspondences. No consonant clusters or multi-letter graphemes were included. Hence, the conclusion is that straightforward letter-sound decoding is more difficult to acquire in the context of a language with a complex phonology than in a language with a simple phonology. Why should this be? One possibility is that the embedding of grapheme–phoneme correspondences in consonant clusters impedes acquisition. Thus, in English, the correspondence p $\rightarrow$ /p/ occurs in isolation and as an element in numerous consonant clusters (sp, spr, spl, pl, pr, mp, lp, mple, etc.). The embedding of simple correspondences in clusters will occur more frequently in beginning reading materials in a complex syllable language than in a simple syllable language.

We tested the *orthographic depth* hypothesis by comparing the languages within the simple and complex series and by relating the outcomes to the intuitive estimates made by the COST A8 consortium (Table 1). Within the simple series, there were two languages—Portuguese and French—which differed from the other Grade 1 samples. The mean level and variance of both word reading (study 2) and nonword reading (study 3) were affected (Figs 6 and 7). A lexical bias in error production occurred in the French sample. The effects cannot be attributed to age, since the French and Portuguese samples were the same age as the remaining simple syllable groups other than Finnish. However, letter labelling accuracy and speed were at the lower end of the range for the series. This could have contributed to the effects on word and nonword reading. Against this, the Finnish sample was equally slow at letter naming but without any consequent effect on word or nonword efficiency.

The tests for effects of orthographic depth in the complex syllable series identified Danish and English as the two languages which differed sharply from the others. Again, both the logographic process (word reading) and the alphabetic process (nonword reading) were affected. The Danish Grade 1 results displayed enormous variability, extending from non-readers up to fully competent readers (Fig. 7), and included refusal and word substitution errors. The Grade 1 and 2 groups both showed enlarged lexicality effects, indicating a special difficulty in developing effective nonword decoding. These outcomes were all present in a much more extreme form in the Scottish results. Mean accuracy in the P1 sample fell below 50% Some children were unable to read and others had dissociated patterns of word and nonword reading analogous to those reported by Seymour and Evans (1999)—*alphabetic dyslexia*, in which nonword reading is massively inferior to word reading, and *logographic dyslexia* in which good nonword reading is combined with poor word reading.

The delayed acquisition of foundation literacy acquisition in Danish and English can be interpreted as a combined effect of syllabic complexity and of orthographic depth. Both languages have a complex syllabic structure and an inconsistent system of grapheme–phoneme correspondences. The more extreme effects observed in the Scottish sample could be a product of the relative immaturity of the children (the difference in starting at 5 vs. 7 years) or of the greater inconsistency of the English orthography.

The use of the regression method made it possible to estimate the amount of reading experience readers of English needed to match European mastery and fluency levels. For familiar words (study 2), a BAS reading age in excess of 7 years was necessary. This was also true of simple nonwords (study 3) where reading ages above 7.5 years were needed. The results closely parallel the earlier findings by Seymour and Evans (1999) and Duncan and Seymour (2000). These studies found a strong correlation (> + 0.8) between familiar word reading and BAS reading age, and a slightly weaker one (> + 0.6) between nonword reading and reading age. They also pointed to 7 years as the reading age at which foundation literacy acquisition was normally complete. Given that the BAS scale starts at 5 years, this suggests that readers of English require 2½ or more years of literacy learning to achieve a mastery of familiar word recognition and simple decoding which is approached within the first year of learning in a majority of European languages. Thus, the rate of foundation literacy acquisition is slower by a ratio of about 2.5:1 in English than it is in most European orthographies. We were not able to make a similar estimate for French or Portuguese. However, the results for Danish suggested that two years may normally be required to achieve mastery of simple decoding (study 3).

We can now consider what mechanism might give rise to these effects. Katz and Frost (1992) formulated an *orthographic depth hypothesis* which asserts that: '. . . shallow orthographies are more easily able to support a word recognition process that involves the language's phonology. . . deep orthographies encourage a reader to process printed words by referring to their morphology via the printed word's visual-orthographic structure' (p. 71). Translated into developmental terminology (Fig. 1), this hypothesis states that acquisition in a shallow orthography may be based on a single (alphabetic) process, whereas acquisition of a deep orthography requires the formation of a dual (alphabetic + logographic) foundation.

This theory suggests an abrupt rather than a graded effect of orthographic depth. If the orthography satisfies relevant criteria of simplicity, then a *single process* alphabetic foundation will be formed as the basis for later reading. If these boundaries are exceeded, then the cognitive architecture of the reading process changes dramatically with the introduction of a *dual process* system (Fig. 1). This type of account corresponds well to our findings. Both the simple and the complex series present a picture of efficient and undifferentiated performance in the majority of languages and an abrupt reduction of efficiency in the deeper orthographies (see Fig. 6). Thus, it appears that there is a *threshold* of orthographic complexity which, once exceeded, results in a step change in the way in which foundation literacy is acquired. Portuguese, French, Danish and English are located above this threshold and the remaining languages below it.

The contrast between the single and dual process accounts offers an explanation of the effect of orthographic depth on rate of learning. In shallow orthographies, the tasks of familiar word recognition and decoding are based on a common set of principles (a consistent set of simple grapheme–phoneme correspondences) and may, effectively, be handled by a single process. In deep orthographies, the principles underlying word recognition and decoding are distinct. Beginning readers of English encounter numerous common words (house, father, nice, was, etc.) which contain complex graphemes, contextual variations and irregularities which are not consistent with their concurrent learning of grapheme–phoneme correspondences. To accommodate this discrepancy, word recognition (the logographic process) follows a distinctive developmental pathway. This is based on a *partial cue* emphasis through which words are initially discriminated by reference to a subset of their component letters, usually the initial and final letters (Ehri, 1997; Stuart & Coltheart, 1988). Decoding (the alphabetic process) relies on sequential left-to-right identification and blending of individual letter-sounds.

Learning under conditions where attention and processing resources are divided between two functions will occur more slowly than learning under conditions where all resources are focused on a single function. Indeed, our data suggest that learning may be about twice as slow under these circumstances. In addition, dual process learning will demand the engagement of a wider range of cognitive skills than single process learning. This may explain why the individual variations in rates of progress are so much wider in the deep than in the shallow orthographies (see Fig. 7). If the dual foundation processes are functionally distinct, it will make sense that the dissociated patterns of logographic and alphabetic dyslexia should occur in some instances (Seymour & Evans, 1999).

According to this interpretation, the slow rate of foundation literacy acquisition by the Scottish sample can be seen as an inevitable consequence of the complexity of the orthography and phonology of English. It may be that the rate of learning can be influenced at the margins, being further delayed by socioeconomic disadvantage (Duncan & Seymour, 2000), possibly accelerated by modifications to the teaching of phonics, and perhaps sensitive to the child's cognitive maturity when the teaching of reading is introduced. However, even where these educational aspects are all optimal, there will always be a cost associated with the implementation of a dual foundation process, and this will create irreducible differences in rates of progress between learning to read in English or other deep orthographies and learning to read in a shallow orthography.

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Appendix

Lists of letter items used in letter knowledge tasks

Finnish	a, b, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, y, ä, ö
Greek	α, β, γ, δ, ε, ζ, η, θ, ι, κ, λ, μ, ν, ξ, ο, π, ρ, ς, τ, υ, φ, χ, ψ, ω
Italian	a, b, c, d, e, f, g, i, l, m, n, o, p, q, r, s, t, u, v, z
Spanish	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, x, y, z, ñ
Portuguese	a, b, c, d, e, f, g, i, j, l, m, n, o, p, r, s, t, u, v, x, z
French	a, b, d, e, f, i, j, k, l, m, n, o, p, q, r, s, t, u, v, x, z
German	a, b, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, w, z
Norwegian	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, y, å, æ, ø
Icelandic	a, b, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, x, y, æ, ö, a, e, í, o, u, y, ð, Þ
Swedish	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, x, y, z, å, ä, ö, a
Dutch	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z
Danish	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, r, s, t, u, v, y, å, æ, ø
English	a, b, c, d, e, f, g, h, i, j, k, l, m, n, o, p, q, r, s, t, u, v, w, x, y, z

Lists of familiar content and function words used in reading tasks

Finnish

Content: koti (home), juosta (run), kolme (three), kirja (book), talo (house), pieni (small), joulu (christmas), takki (coat), isä (father), koulu (school), tehdä (make), vene (boat), hyvä (good), pallo (ball), kaunis (beautiful), talvi (winter), äiti (mother), kaksi (two).

Functor: siellä (there), se (it), vain (only), mikä (what), alas (down), ei (no), tässä (here), taas (again), että (that) pian (soon), ylös (up), täällä (here), on (is), joka (that), kun (when), mutta (but), me (we), missä (where).

Greek

Content: *παιδιά* (children), *σπίτι* (house), *παππούς* (grandfather), *βροχή* (rain), *χωριό* (village), *μάτια* (eye), *μήλο* (apple), *πόρτα* (door), *βράδυ* (night), *γιαγιά* (grandmother), *λαγός* (rabbit), *μέρα* (day), *πουλιά* (bird), *ήλιος* (sun), *χέρι* (hand), *θείος* (uncle), *γραμμή* (line), *φορά* (time).

Functor: *και* (and), *για* (for), *πως* (how), *εδώ* (here), *πάνω* (up), *τώρα* (now), *όπως* (as), *μόνο* (only), *πάντα* (always), *που* (where), *από* (from), *μέσα* (into), *εκεί* (there), *τότε* (then), *όμως* (but), *όταν* (when), *κάτω* (down), *μετά* (after).

Italian

Content: ape (bee), ago (needle), ora (hour), lago (lake), cima (peak), dama (lady), prato (meadow), resto (rest), colpo (blow), ala (wing), oca (goose), uva (grapes), pane (bread), mela (apple), toro (bull), libro (book), ponte (bridge), treno (train).

Functor: il (art.), la (art.), su (on), fra (between), per (for), con (with), del (of), di (of), tra (between), lo (him), sul (on), un (art.), in (in), al (to), da (from), nel (in), le (art.), sui (on).

Spanish

Content: niño (child), alto (tall), padre (father), arbol (tree), fin (end), uno (one), flor (flower), gato (cat), soy (I am), casa (house), algo (something), madre (mother), azul (blue), sol (sun), dos (two), tren (train), goma (rubber), estoy (I am).

Functor: de (of), para (to), con (with), entre (between), desde (from), cual (which), aquí (here), poco (few), tan (so), te (you), pero (but), por (by), sobre (on), despues (after), quien (who), allí (there), mucho (much), mas (more).

Portuguese

Content: pe (foot), luz (light), ar (air), asa (wing), gato (cat), ovos (eggs), carta (letter), prado (graze field), vento (wind), pa (sickle), sol (sun), as (ace), uva (grape), bola (ball), anel (ring), porta (door), blusa (blouse), mundo (world).

Functor: tu (you), por (by), as (art.), ali (there), cada (each), logo (soon), umas (some), mesmo (same), nunca (never), se (if), tal (such), os (art.), uma (art.), para (for), como (as), apos (after), desde (since), tanto (much).

French

Content: heure (hour), voir (see), air (air), femme (woman), vent (wind), roi (king), homme (man), main (hand), jour (day), aimer (love), ete (summer), idee (idea), monsieur (mister), dîner (dinner), souris (mouse), ecole (school), image (picture), etoile (star).

Functor: donc (therefore), une (art./one), chaque (each), elle (she), pour (for), dans (in), il (he), qui (who), nous (us), enfin (at last), alors (then), ici (here), encore (still), assez (enough), avec (with), pendant (during), deja̓ (already), souvent (often).

German

Content: Kind (child), Brot (bread), Oma (granny), Maus (mouse), Auto (car), Mutter (mother), Esel (donkey), Wasser (water), Torte (cake), Schnee (snow), Papa (daddy), Stein (stone), Zahn (tooth), Winter (winter), Spiel (game/play), Fisch (fish), Teller (plate), Schule (school).

Functor: der (art./that), mit (with), bis (until), und (and), was (what), du (you), sind (are), es (it), wer (who), wir (we), ist (is), zu (to), er (he), hat (has), ein (article), wo (where), das (art./that), ich (I).

Norwegian

Content: bok (book), leke (toy), far (father), jente (girl), bake (bake), tre (three), skole (school), dør (door), hjem (home), mor (mother), båt (boat), kake (cake), gutt (boy), lekse (lesson), hus (house), fly (airplane), saft (juice), ball (ball).

Functor: min (my), på (on), ut (out), og (and), her (here), inn (in), ikke (not), der (there), eller (or), som (like), alle (all), fra (from), en (art.), hvor (where), også (too), til (until), hvem (who), din (your).

Icelandic

Content: las (lock), pabbi (daddy), har (hair/high), koma (come), lesa (read), rola (swing), mus (mouse), sol (sun), mamma (mummy), bok (book), hus (house), pakki (package/present), skoli (school), leikur (game), afmæli (birthday), fugl (bird), stræto (bus), jol (Christmas).

Functor: að (to/at), og (and), sem (that/which), eða (or), með (with), um (about), til (to), en (but), fra (from), her (here), Þegar (when), síðan (since), aftur (again), uppi (up), ekki (not), segir (says), hvar (where), sagði (said) (after).

Swedish

Content: liv (life), barn (children), höll (held), hand (hand), del (part), far (father), mamma (mummy), väg (way), kvinna (woman), dag (day), tid (time), hem (home), folk (people), fall (case), mor (mother), ögon (eyes), dörren (the door), brev (letter).

Functor: jag (I), på (on), inte (not), för (for), ett (art.), man (you), sin (his/her), ut (out), mot (against), en (one), som (like), var (was), till (to), så (so), när (when), från (from), kan (can), nej (no).

Dutch

Content: naam (name), bal (ball), kok (cook), roos (rose), boek (book), geit (goat), mus (sparrow), huis (house), man (man), school (school), goud (gold), boot (boat), vis (fish), stad (town), pot (pot), boer (farmer), vuur (fire), dik (thick).

Functor: hij (he), er (there), niet (not), ik (I), het (it), op (on), voor (before), in (in), de (the), een (a), van (of), ze (they), die (that), met (with), je (you), is (is), maar (but), ze (they).

Danish

Content: skole (school), bil (car), ser (see), far (father), dag (day), mor (mother), lille (little), hjem (home), dyr (animal) hus (house), to (two), båd (boat), elefant (elephant), bor (lives), tur (trip), blå (blue), træ (tree), ord (word).

Functor: min (my), om (about), dem (them), alle (all), ud (from), man (you), ikke (not), må (may), er (is), som (like), hvor (where), du (you), også (also), har (has), men (but), til (to), sin (his/her), her (here).

English

Content: one, high, home, school, boy, bird, play, yellow, birthday, house, boat, two, teacher, toy, elephant, tree, Tuesday, blue.

Functor: my, them, about, all, your, when, how, out, many, as, where, you, why, every, saw, here, said, have.

Lists of nonwords used in reading tasks

Finnish

Monosyll.: eh, vis, li, nä, kup, da, yt, os, röm, is, vor, ke, tyn, ju, ep, ät, hal, mö.

Bisyll.: värö, ame, hopa, ypöt, onu, ehi, iman, olus, kaju, ysö, vami, evot, ryhe, edä, ukes, pilo, atu, ojun.

Greek:

Monosyll.: ϵς, λον, ογ, γϵν, βο, αλ, χϵ, φϵς, ξι, ιμ, χος, αδ, τϵς, μο, ϵβ, πα, βιν, νι.

Bisyll.: ίμο, τάρι, ϵδόν, άπι, ίλας, χίφα, αχέν, όγϵ, ψάγο, όπι, κίσϵ, έψιν, άκο, άζος, πόβϵ, ίκας, έτα, μάτο.

Italian:

Monosyll.: af, id, ot, so, be, fu, lat, mur, pes, ul, or, es, pa, ti, de, den, pol, fir.

Bisyll.: tibe, sopa, fude, ulaf, erid, otes, ari, ela, ope, beti, defu, pabe, idor, aful, ides, ifa, ubi, aru.

Spanish

Monosyll.: ez, fo, in, su, nes, ur, val, fos, ta, bu, sen, ar, ma, ol, re, dis, em, far.

Bisyll.: oti, omen, fite, inos, abo, ledo, asur, efa, fovu, ubil, ufe, suñe, asu, udon, ib, fipu, edos, sare.

Portuguese:

Monosyll.: ba, zo, fi, gus, nir, sor, ur, al, ol, vu, jo, ga, tor, ros, cas, or, ul, er.

Bisyll.: eda, iro, afo, dajo, veca, buna, eris, ogal, apir, ope, emo, ila, tega, mipo, fuba, uvel, adol, ifos.

French

Monosyll.: ur, al, oc, bo, da, ja, buc, nir, sof, ol, ip, af, ru, ko, fi, raf, vor, tup.
Bisyll.: uba, ori, afo, nita, muro, silu, itol, apuf, udic, ita, ulo, oba, baru, vina, jotu, otip, arol, ufir.

German

Monosyll.: Ol, me, tis, ak, su, kup, it, ko, dus, sim, gi, af, hok, he, us, jal, pa, et.
Bisyll.: ebol, abi, rela, awit, edu, soti, orus, uki, lane, eho, jefi, uwal, oga, huko, ibam, uki, mipu, etus.

Norwegian

Monosyll.: tø, val, mu, bik, po, ir, tip, an, es, sut, kå, im, bøl, na, fok, ar, ve, el.
Bisyll.: ase, safo, ipa, neto, alok, miva, obe, edat, øger, toke, ate, evan, bega, ode, itåp, fimo, øle, efas.

Icelandic

Monosyll.: oð, ap, ul, gö, fu, va, jar, Þis, mek, ín, em, ot, ri, ba, go, dul, jök, Þas.
Bisyll.: era, ofi, íku, ruli, hipo, natu, akat, imok, aneð, abu, emi, upa, Þeni, fulo, hísu, alip, utak, opis.

Swedish

Monosyll.: ag, ef, em, li, ku, ci, fev, dåk, nol, ot, öv, op, ba, hu, ky, gos, bäl, kes.
Bisyll.: ata, äri, oså, kaby, nite, tila, årit, avad, arot, una, avå, ety, väse, koge, föja, övan, uted, alog.

Dutch

Monosyll.: ak, pi, lo, ruf, ol, kal, ek, ro, pum, ki, bog, em, lir, us, sa, mer, du, ip.
Bisyll.: abo, kosi, seku, ores, upe, aler, oki, upid, dalo, pile, upa, ebor, efu, abi, bano, imon, ekal, rupa.

Danish

Monosyll.: mo, git, yr, pæ, tas, ne, tøb, æk, øt, sa, kæt, us, gy, vul, æn, lat, ut, fi.
Bisyll.: øbe, ækis, gima, alo, imal, tasi, usøk, æsi, sibe, utå, alus, møku, ite, vamo, øsas, ilu, læfi, atib.

English

Monosyll.: tas, le, eb, dem, vo, im, ga, os, fip, du, kib, ig, je, ut, vap, ca, lem, op.
Bisyll.: uli, idap, umic, feno, elot, mola, aco, oma, suba, uba, imal, sero, osi, bina, gopa, eto, afen, opud.