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Influences of orthographic consistency and reading instruction on the development of nonword reading skills

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Wimmer and Goswami (1994) report that seven-, eight-, and nine-year old English children had considerably more difficulties with a nonword reading task than German children who acquire an orthography with highly consistent grapheme-phoneme correspondences. In Study 1, seven-, eight-, and nine year old English children receiving a phonics instruction were presented with the same task and compared with the children tested by Wimmer and Goswami. Study 2 is a replication with different samples of English children receiving the standard eclectic approach combining both whole-word and phonics strategies, English children receiving a phonics teaching approach and German children who are taught via phonics methods and acquire a consistent orthography. Children from Grades 1 to 4 were tested. In both studies, the English phonics children read the nonwords with almost the same accuracy and speed as the German children. In Study 1, the English phonics children performed clearly better on nonword reading than the English standard sample. In Study 2, this difference was also evident but less marked. In Grade 1 English phonics as well as English standard children had clearly more difficulties with phonological decoding than German children indicating a relevant influence of orthographic consistency.

During the last few years, a number of studies have shown consistently that reading acquisition in English is more difficult and progresses more slowly than in many other orthographies. More specifically, the process of phonological decoding, that is the systematic translation of the graphemic sequence into a phonological code has been shown to be hard to acquire for English speaking children. Phonological decoding is central in reading acquisition as it allows the young reader to tackle the many unknown words that he encounters. Furthermore, Share (1995) postulated phonological decoding as a self-teaching mechanism

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providing the reader with opportunities to store successfully decoded grapheme strings in the orthographic lexicon. In nonword reading tasks, the main indicator of children's phonological decoding abilities, English speaking first graders typically show high error rates between 40 and 80% (Jorm, Share, MacLean, & Matthews, 1984; Juel, Griffith, & Gough, 1986; Seymour & Elder, 1986; Treiman, Goswami, & Bruck, 1990) while in many other orthographies like Dutch, Italian, Turkish, Portuguese, Greek, or German the error rate is consistently below 25%. This was shown in studies assessing nonword reading abilities in one orthography (Coenen, van Bon, & Schreuder, 1997; Cossu, Gugliotta, & Marshall, 1995; Öney & Durgunoglu, 1997; Pinheiro, 1995; Porpodas, 1989; Wimmer & Hummer, 1990) and also in a number of studies comparing directly the reading abilities of English children with children acquiring other orthographies (Goswami, Gombert, & de Barrera, 1998; Frith, Wimmer, & Landerl, 1998; Landerl, Wimmer, & Frith, 1997; Öney & Goldman, 1984; Wimmer & Goswami, 1994). Interestingly, there exists not a single empirical study showing the reverse finding that English children are better in decoding than children in any other orthography. Obviously, there is a highly consistent difference that needs theoretical explanation.

The process of phonological decoding can be further divided into two subcomponents. First, the reader must know the letter-sound code, that is, the grapheme-phoneme correspondences, and second, he must be able to perform the process of phonological assembly, that is to blend the translated phonemes into syllable or word pronunciations. Young English readers are perhaps disadvantaged in comparison to children acquiring other orthographies in both respects. First, the phonological code of English orthography is highly complex. English has a deep orthography depicting morphological rather than phonological consistencies. It is characterized by low consistency of grapheme-phoneme correspondences, especially for vowels. German, Italian, Greek, Dutch, Portuguese and Turkish are all more shallow on the continuum of orthographic depth. In these orthographies, the consistency of grapheme-phoneme conversion rules is high so that beginning readers can successfully rely on a strategy of translating the grapheme string into a phonological code. It seems obvious that orthographic consistency is an important factor in reading acquisition.

The second important factor is reading instruction. In German, for example (as in most other consistent orthographies), reading is typically taught via a straightforward phonics teaching regime fostering both subcomponents of phonological decoding through heavy emphasis on teaching of letter-sound correspondences and blending and sounding out words. For example, in a reading primer which is widely used in Austria (Eibl, Lampée-Baumgartner, Borries, & Tauschek, 1996), children learn the letter-sound correspondences for *m*, *o*, *a*, *i* and *l* through play during the first weeks of reading instruction (complemented by many phonemic awareness games and lessons in which the teacher reads stories to the children and discusses them to awaken interest in reading). Then, the children start to practice sounding out simple words like *Oma*, *Mama*, *im* and even short sentences like *Mia malt mit Oma* (Mia paints with granny). Nonword decoding is practiced for example by asking children to read the spell of a mysterious magician ("*mora mora mori, mira mira lori, lora lira lot*" etc.). Soon, children are able to answer written questions about a picture in the primer like "*Warum ist Timo im Turm*?" (Why is Timo in the tower?). Thus, although the children are far from being able to read books because they know only part of the phonological code, they learn that phonological assembly is a useful technique to work out short but meaningful written texts.

Such a straightforward phonics teaching approach is suitable for consistent orthographies where most graphemes correspond to only one phoneme. Due to the high complexity of the phonological code in the English orthographic system, more than one grapheme-phoneme correspondence would have to be taught for many graphemes. Perhaps it is the high complexity of the grapheme-phoneme system that has been responsible for the fact that traditional phonics programs in England and the United States were characterized by monotonous drill and divorce from real language. As a reaction against these drill programs, whole-language teaching approaches were developed in which children were encouraged to read books right from the beginning, relying on whole word recognition and the use of contextual cues or meaning-

based strategies (Goodman, 1967; Smith, 1978). Empirical research, on the other hand, consistently shows that teaching approaches emphasizing phonics have generally better outcomes, at least for the development of decoding and spelling skills, than whole word methods (Adams, 1990; Bruck, Treiman, Caravolas, Genesee, & Cassar, 1998; Byrne, 1998; Henry, 1993; Snowling, 1996). Many teachers therefore apply a mixed approach, developing children's whole word recognition abilities as well as providing information about correspondences between spoken and written linguistic units. In contrast to German, where the consistent orthographic structure plainly suggests that teaching of letter sounds is the most efficient means to introduce children to the alphabetic code, English researchers and practitioners are still unsure if children should be taught letter names or letter sounds (Adams, 1990) or if they should first be taught about consistencies for larger phonological units like onsets and rimes because these units are more consistent than the simple grapheme-phoneme correspondences (Goswami, 1994). These discussions are obviously caused by the high complexity of the phonological code of English orthography. It is, however, remarkable that as a consequence of the uncertainties about the most efficient way to teach the complex phonological code, many teaching regimes in English also do not emphasize the other subcomponent of phonological decoding, namely the assembly process. In general, reading instruction regimes in English put more emphasis on whole word recognition and less on phonological decoding abilities than in German and most other consistent orthographies.

Although the standard reading instruction method in English classrooms is a mixed approach, providing a combination of whole word and phonics methods (with widely varying degrees of emphasis on one or the other strategy), there are some schools which provide a consistent phonics reading instruction which is close to the regime described above for German. The English phonics children tested for the present study were taught by a very consistent phonics method developed by Lloyd (1994). The program starts by introducing the most typical grapheme-phoneme correspondences for 43 phonemes. The first graphemes introduced are *s*, *a*, *t*, *i*, *p* and *n*. For each grapheme, the children are told a story in which the specific phoneme is associated with a typical gesture (e.g., rubbing the tummy and saying "mmmm" when introducing *m*). Multisensory associations have been shown to be helpful in reading acquisition (Hulme, 1981). As soon as the first grapheme-phoneme correspondences are introduced, the teacher demonstrates the process of blending by presenting spellings of simple three letter words (e.g., *pan*, *sit*, *tap*), asking the children to say the sounds (always together with the associated gestures) and then reading the word to the children providing them with an opportunity to realize the similarities between the sound sequence and the word. Children are consistently encouraged to work out how a letter sequence is pronounced and how a spoken word is spelled by relying on their knowledge of grapheme-phoneme correspondences. Words including consonant clusters are only introduced when a child is able to decode simple CVC-words. Alternative graphemes that can represent the same phonemes are introduced only after the most common grapheme is well established in children's memories. Thus, children receive heavy training with respect to both subcomponents of phonological decoding, i.e. grapheme-phoneme correspondences and blending and segmenting word pronunciations. High frequency irregular words are taught via the look-cover-write-check method, thus keeping this word type conceptionally apart from regular words that can be sounded out.

For the present study, we tested English children receiving this straightforward phonics teaching approach with a reading task developed by Wimmer and Goswami (1994). Wimmer and Goswami presented seven-, eight- and nine-year old English and German readers with lists of number words between *two* and *twelve*, which are very similar in the two languages (e.g., *three* -- *drei*, *five* – *fünf*). In a second condition, the children were asked to read nonwords that were derived from the number words by exchanging the consonantal onsets (e.g., *nee* was derived from *nine* and *three*). Thus it was taken for granted that the nonwords were also similar in the two languages and that they consisted of phonological units (onsets and rimes) that were typical for each orthography. In a third condition, the children were asked to name, as quickly as possible, the numerals corresponding to the number words taking

account of any differences in general naming or articulation speed. Wimmer and Goswami found no differences between the two language groups for the numeral and number word conditions. On the nonword reading task, however, English children of all three age levels made significantly more errors and read reliably more slowly than their German counterparts. The reading task developed by Wimmer and Goswami is currently translated to a number of other orthographies like French, Italian, Finnish, Swedish, Portuguese and Dutch, all of which have higher grapheme-phoneme consistency than English. A preliminary inspection of the data that have currently been collected shows that in general the findings of the original study (no, or minor, differences for numerals and number words, but a considerable disadvantage of English children on nonword reading) are confirmed (Wimmer & Aro, 1999; Landerl, 1997).

The present research was designed in order to find out more about the contributions of instruction method and orthographic consistency on reading acquisition by comparing three groups of children. Two groups of English children acquire the same orthography, but differ in the method of reading instruction they receive. The children of the English standard group received the widely used eclectic approach that combines phonics and whole-word methods while the English phonics children were taught via a straightforward phonics approach that is comparable with the method typically used in German speaking countries. The third group were German readers who received a phonics teaching approach and acquired a consistent orthography. If the main reason for the observed differences between English and German readers is the difference in instruction method, then similar differences should be evident between the two groups of English readers. If, however, orthographic consistency is the main contributor, the differences between the two orthographies should also be evident between the English phonics and the German group. Study 1 is a pilot study in which groups of seven-, eight-, and nine-year old children receiving phonics teaching were compared with the English and German samples tested by Wimmer and Goswami (1994). In Study 2, new samples of English children receiving the standard mixed vs. a phonics teaching approach as well as another German sample were tested under more controlled conditions.

Of course, one must be aware of the methodological problems generally associated with cross-cultural studies. Although differences in orthographic consistency and teaching methods are theoretically important factors influencing children's reading development, there are certainly other factors like social background, parental support, teacher personality or differences in general cognitive abilities between classrooms which cannot always be controlled. As far as possible, comments on these factors will be made for the participating samples. We are not claiming that the data from the two studies that will be presented in the following are representative in the sense that sample selection ensures generalizability to the whole population. However, if a consistent pattern emerges in the two studies in which data from altogether 524 children from 21 classrooms in 5 different schools will be reported and if this pattern is in line with other findings in the research literature, a theoretical discussion of this pattern seems justified.

Study 1

Method

Participants. The 76 children (46 boys, 30 girls) participating in the present study all attended a state school in the U.K. which provides the straightforward phonics teaching approach described above. In accordance with the Wimmer and Goswami (1994) study, children of three age groups, seven-, eight- and nine-year olds, were tested. Table 1 presents the mean ages of the children of the present study as well as those of the participants of the original Wimmer and Goswami study.

Table 1

Mean ages (SDs) and numbers of subjects for the English standard, English phonics and German groups

	English standard		English phonics		German	
	age	*N*	age	*N*	age	*N*
Grade 2	7;0 (0;4)	23	7;0 (0;1)	25	7;10 (0;4)	30
Grade 3	8;0 (0;4)	24	8;0 (0;2)	27	8;10 (0;5)	29
Grade 4	9;0 (0;3)	25	9;0 (0;2)	24	9;11 (0;5)	21

The English children of the Wimmer and Goswami study will be referred to as "English standard" as they received the standard mixed approach of reading instruction combining whole-word and phonics methods. As can be seen in Table 1, the mean ages of the two English groups are very similar for all three age levels. The German children of the original study were tested in a state school in a small Austrian town. They are called "German" because this is their native language and the orthography they acquire. They were somewhat older than the English groups. However, with respect to length of formal reading instruction, the German children were disadvantaged. The German children were tested at the beginning of Grades 2, 3, and 4 while both English groups were assessed in the middle of Grades 2, 3, and 4.

Procedure. Nonwords, Number words and Numerals: This reading task was developed and described in detail by Wimmer and Goswami (1994). It is a continous reading task which contrasts reading of number words with the reading of nonwords and numerals. Short number words with consonantal onset between *two* and *twelve* (excluding *eight* and *eleven*) were used, as these words have comparable pronunciation and spelling in German and English (e.g., *drei-three*, *four-vier*). The nonwords (see Appendix) were derived from these number words by exchanging the consonantal onsets, leaving the rimes intact (e.g., *thro* was derived from *three* and *two*). These nonwords can be read by analogy to the number words and to other neighbours. Additionally, children were also presented with the corresponding numerals. Each of the three conditions (number words, nonwords and numerals) consisted of two lists of 18 items, created by including each of the nine items selected for the study twice in each list. The presentation of the lists was intended to mimic "real" reading, and so the items appeared in sequence printed left-to-right on a single page in separate lines of text. The two lists for each condition were given in immediate succession. There were six different orders of the pairs of lists. Children were asked to read each list as quickly and accurately as possible. Prior to the experimental lists, a practice sheet with six items was given for each of the three conditions.

Results

Nonword reading. The main focus of interest in the present study is on the development of children's phonological decoding abilities under different types of instruction and in different orthographies. Two scorings were made for English phonics children's nonword reading errors. In the strict scoring, children's nonword readings were scored following the criterion used by Wimmer and Goswami (1994): Pronunciations were counted as correct whenever a real word analogue for the chosen pronunciation existed. Thus, for the nonword *nour*, pronunciations that rhymed with *our*, *tour* and *four* were counted as correct, for the nonword *twive*, pronunciations that rhymed with *five* and *give* were also both counted as correct. However, the scoring criterion developed by Wimmer and Goswami seemed to place the English phonics children at a disadvantage in comparison to the German children. For the

German nonword items it makes no difference if a reading attempt is based on the basis of grapheme-phoneme correspondences or on the basis of an analogy to an existing word. Because of the consistency of German orthography, these pronunciations would be identical. In English, on the other hand, a spelling can be read based on grapheme-phoneme correspondences that occur in real words, but still not result in a pronunciation that is analogous with an existing word. Thus, we decided to do a second, more lenient scoring, where any grapheme-to-phoneme translation which exists in a real English word – irrespective of position and graphemic context – was accepted. Examples for pronunciations that were counted as correct in the lenient but incorrect in the strict scoring are *thro* pronounced with short *o* (/θro/), or *sen* pronounced with long *e* (/si:n/). In this lenient scoring, it was also counted as correct if a child pronounced a silent *e* (e.g. /twivə/ for *twive*). In the Appendix for all items the pronunciations that were counted as correct under the strict and the more lenient criterion are listed. Obviously, owing to the high consistency of German orthography there is almost always only one acceptable pronunciation of the presented nonwords. Unfortunately, the lenient scoring could not be done for the English standard group because the data sheets of this sample were not accessible.

Table 2 presents the number of nonword reading errors (upper section) and the reading times per item (lower section) combined for the two lists for the English phonics group as well as for the English standard and German groups tested by Wimmer and Goswami (1994).

Table 2

Errors and reading times/items (in s) for the nonword condition

		English phonics		
	English standard	Strict scoring	Lenient scoring	German
		Errors		
Grade 2 *M* (*SD*)	12.30 (9.86)	6.96 (5.91)	4.12 (4.13)	4.80 (4.37)
Md	12.0	6.0	3.0	3.5
Grade 3 *M* (*SD*)	13.38 (11.58)	5.07 (6.59)	2.81 (4.70)	2.63 (2.01)
Md	12.0	3.0	1.0	2.0
Grade 4 *M* (*SD*)	8.76 (9.66)	4.58 (6.08)	3.63 (4.98)	3.43 (2.54)
Md	4.0	2.5	2.0	3.0
		Time/Item (s)		
Grade 2 *M* (*SD*)	3.30 (2.83)	3.07 (1.97)		2.14 (1.14)
Md	2.31	2.61		1.88
Grade 3 *M* (*SD*)	2.90 (1.95)	1.85 (1.23)		1.53 (0.61)
Md	2.50	1.50		1.42
Grade 4 *M* (*SD*)	2.03 (1.35)	1.41 (0.83)		1.30 (0.48)
Md	1.39	1.08		1.22

First, nonword reading accuracy according to the strict criterion was compared for English standard and English phonics readers. In a group (English standard vs. English phonics) x grade level ANOVA the group effect was highly significant ($F(1,147)=18.0$, $p<.001$). There was no effect of grade level and no interaction between grade level and group ($Fs(2,147)=1.7$ and 0.8, respectively, $p>.1$). Inspection of Table 2 shows that the English standard children of all three grade levels on average made about twice as many errors as the English phonics children. However, the median scores show that at least in Grade 4, English standard children's nonword reading accuracy is more similar to that of the phonics group than in the two lower grades.

According to the strict criterion, the English phonics children of all three grade levels made more nonword reading errors than the German children ($F(1,152)=5.9$, $p<.05$). But as already mentioned, the more adequate comparison between English phonics and German children is found in the more lenient scoring in which all acceptable grapheme-phoneme translations, irrespective of graphemic context, were counted as correct. A group (English phonic vs. German) x grade level ANOVA showed no reliable effects (group: $Fs(1,156)=0.03$, grade level and group x grade level: $F(2,156)=2.7$ and 0.2, respectively, $p>.05$). Table 2 shows quite remarkably, that according to the lenient scoring, the numbers of errors for the English phonics children for all three grade levels are as low as those of the German children.

The reading errors of the English phonics children are usually close to the target pronunciation (e.g., /fli:f/ or /feləf/ for *felve*, /twevən/ for *twive*) indicating that a faulty phonological decoding process was carried out. However, three of the second graders gave no response at all for between one and five nonwords showing that these children have difficulties with the process of phonological decoding. But even these three children pronounced the majority of the items correctly, showing that they basically knew how phonolgical decoding works. This no-response type of error did not occur with the German children.

The reading times for the nonwords were added up for the two lists and then divided by the number of items. To reduce the effect of outliers, the mean reading times per item were log-transformed for statiscical analysis. The lower section of Table 2 shows that the English phonics children's nonword reading times lie between those for the English standard and the German children. This was confirmed by two group x grade level ANOVAs comparing English phonics children separately with English standard and German children: English phonics children's reading times were consistently lower than those of the English standard children ($F(1,147)=4.4$, $p<.05$), but higher than those of the German children, although this difference only approached significance ($F(1,156)=3.2$, $p<.08$). In both analyses, the main effect of grade level was highly significant ($F(2,147)=9.6$ and $F(2,156)=19.5$, $p<.001$) while the group x grade level interaction was not ($F(2,147)=1.6$ and $F(2,156)=1.3$, $p>.1$). Individual comparisons for English phonics and English standard groups separate for each grade level showed that the difference is mainly due to a consistent advantage of the phonics group in Grade 3 ($t(49)=2.2$, $p<.05$) and Grade 4 ($t(47)=2.0$, $p=.05$), while in Grade 2 the difference is not significant ($t(46)=0.2$, $p>.1$). Individual comparisons for the difference between English phonics and German children proved only reliable in Grade 2 ($t(53)=2.0$, $p<.05$), but not in the higher grades ($t(55)=0.9$ and $t(43)=.3$, $p>.1$).

In summary, the English phonics children's reading accuracy for nonwords was considerably higher than that of the English standard children. This difference in decoding skills cannot be reduced to differences in scoring as even according to the strict scoring criterion English standard children committed about twice as many errors as the English phonics children. When English phonics children's nonword reading is scored accoring to the more lenient criterion, their accuracy is actually similar to that of the German children. In Grade 2, English phonics children's reading speed was as low as that of the corresponding English standard group while in Grades 3 and 4 they were able to read the nonwords with the same fluency as the corresponding German groups.

Number words and numerals. As was found by Wimmer and Goswami (1994), very few children made errors in reading the numerals or the number words aloud[1], and therefore only the reading times could be subjected to statistical analysis. The main question with respect to reading times for number words and numerals was if the differences in reading speed for the nonwords could be reduced to differences in general naming or articulation speed. This, however, was not the case. Any differences in number word or numeral reading speed that could be observed were rather in favour of the English standard children, that is the group who had performed worst in the nonword condition. In a group (English standard; English phonics; German) x condition (number words vs. numerals) x grade level ANOVA, the group effect was not reliable ($F(2,220)=1.4$, $p>.1$).

Discussion

In Study 1 English children receiving a straightforward phonics reading instruction were considerably better able to read short nonwords than children receiving a standard mixed approach combining phonics and whole word methods. Quite impressively, English phonics children's nonword reading abilities were almost as good as those of German children who acquire an orthography with consistent grapheme-phoneme correspondences. The differences in reading speed for nonwords cannot be caused by differences in general articulation speed as the only differences in reading speed for numerals and number words were in favour of the English standard children.

There are, however, some indications that the acquisition of phonological decoding was still more difficult for the English phonics than for the German children. English phonics children read the nonwords slower than their German counterparts, especially the youngest group. Furthermore, three children of the youngest English phonics group gave no response for some of the nonwords showing that they did not know how to tackle these items. This no-response error type did not occur in the present German sample and is in general quite atypical for young German readers. Among almost 600 German children tested at the end of Grade 1, Mayringer, Wimmer, and Landerl (1997) found only six children who were not yet able to carry out the process of blending.

A relevant methodological point that could be made in Study 1 concerns differences in scoring children's nonword pronunciations. In the original study by Wimmer and Goswami (1994) a rather strict criterion was applied. Wimmer and Goswami counted a nonword pronunciation as correct only if it was analogous to the pronunciation of an existing word spelling. This strict criterion probably put the English children at a disadvantage as in English a nonword pronunciation can reflect correct appliaction of grapheme-phoneme decoding, without resulting in a word analogous pronunciation. But Study 1 also shows that although scoring criterion has an influence, the differences between English and German readers cannot be solely explained by scoring differences. For the English phonics group, both, a strict and a more lenient scoring criterion were applied. As one would expect, the strict criterion led to a higher number of reading errors than the lenient criterion. But even according to the strict criterion English phonics children of all three grade levels showed significantly higher nonword reading accuracy than the English standard children. Another methodological critisism that must be made is that Wimmer and Goswami did not control for differences in reading level or general cognitive development. In Study 2 we applied control measures for these factors.

In Study 1, German and English children differred both with respect to age and with respect to length of formal reading instruction. The German children were somewhat older than the corresponding English groups, but nevertheless had received less formal reading instruction owing to later school entry. In Study 2, we decided to match the two groups at least on one of these two variables and tested children at the same point in their school career, thereby accepting differences in chronological age. In addition to second, third and fourth graders who correspond roughly with the age-groups tested by Wimmer and Goswami, we tested groups of children after only one year of reading instruction. One might argue that the influence of both reading instruction and orthographic consistency should be most clearly evident in the first stages of reading acquisition.

Study 2

Method

Participants. The 111 children (51 boys, 60 girls) of the *English standard* group attended a state school in a rather wealthy area in North London. These children received a mixed

approach of reading instruction, combining both whole word and phonics techniques. According to their teachers, the children in this school received a phonics lesson once a week, following the requirements of the British national curriculum. The 83 children (53 boys, 30 girls) of the *English phonics* group attended a state school in a predominantly working class area of a middle sized town in Suffolk which provides the straightforward phonics teaching approach described in the Introduction. The third group were 102 children (55 boys, 47 girls) from a state school in a small Austrian city. These children received the synthetic-analytic teaching approach emphasizing grapheme-phoneme correspondences and the process of blending that is most widely used in Austria. In each of the three schools, one classroom of each year (Grade 1 to Grade 4) was tested. In the two English schools, children whose first language was not English were excluded. In the English phonics school only children that had received this particular reading instruction method right from the start were included in the study. This explains why the subject numbers for this group are somewhat lower than in the other groups. Table 3 presents the characteristics of the participants.

Table 3

Mean age (SDs), reading level and numbers of subjects for the English standard, English phonics and German groups

	English standard			English phonics			German		
	age	reading age[a]	*N*	age	reading age[a]	*N*	age	reading % (quartiles)[b]	*N*
Grade 1	6;3 (0;2)	7;1 (1;3)	26	6;2 (0;3)	6;9 (0;5)	19	7;5 (0;4)	61 (71-40)	26
Grade 2	7;4 (0;2)	8;11 (2;1)	27	7;1 (0;3)	8;6 (1;2)	24	8;10 (0;5)	41 (81-14)	26
Grade 3	7;10 (0;3)	9;2 (2;4)	28	8;0 (0;4)	9;5 (1;1)	22	9;10 (0;3)	50 (71-10)	25
Grade 4	8;10 (0;3)	11;2 (2;0)	29	9;0 (0;4)	10;10 (1;9)	18	10;7 (0;4)	61 (90-41)	25

Note. [a]BAS II: Word Reading; [b]SLRT Word Reading (standardized reading tests in German do not give reading ages. To show that the German children are age equivalent readers, the median percentile scores as well as the quartiles are presented).

As can be seen in Table 3, the mean ages of the two English groups are very similar for all age levels. Children's current reading level was assessed with the Word Reading subtest of the British Abilitiy Scales II (Elliott, 1996). In an analysis of variance with group and grade level as independent and reading age as dependent variable only grade level showed a significant effect ($F(3,193)=44.1$, $p<.001$). The main effect of group and the group x grade level interaction were not reliable ($F(1,193)=0.9$ and $F(3,192)=0.4$, $p>.1$). Table 4 shows that the mean reading ages for all four grade levels were above the chronological ages both for the English standard and English phonics group. Especially the second graders of the English standard group performed surprisingly well so that their mean reading age is in fact almost as high as that of the third graders. An interesting difference between the two groups is that among the English phonics readers only 8 children have a reading age that is lower than their chronological age with a maximum delay of eight months while 24 children of the English standard group have lower reading than chronological ages. Here, eight children show a delay in reading development of more than a year and for one child the delay is more than two years. The standard deviations for reading age are higher for the English standard than for the English phonics group (Levene's test for equality of variances: $F(1,192)=7.3$, $p=.008$).

Finally, to ensure that the children of the two English schools were comparable, we also assessed their nonverbal cognitive abilities with Raven's Coloured Progressive Matrices. In a 2 x 4 analysis of variance with Raven raw scores as dependent variable neither the main effect of group nor the group x grade level interaction were reliable ($F(1,193)=2.2$ and $F(3,193)=1.9$, $p>.1$). Only the effect of grade level was significant ($F(3,193)=31.7$, $p<.001$)

Table 3 shows that the German children of all four grade levels were considerably older than the English children. This age difference is caused by different ages of school entry in Austria and the UK. In Austria, children enter school in the autumn after their sixth birthday while in the UK children enter reception classes shortly before their fifth birthdy. These age differences can certainly not be ignored, howerer, in the present study we were mainly interested in the effects of orthographic consistency and reading instruction on children's reading development, and therefore we tested children who had received one, two, three and four years of formal reading instruction.

German children's current reading level was assessed with the text reading subtest of the Salzburger Lese- und Rechtschreibtest, a standardized reading test developed in our lab (Landerl, Wimmer, & Moser, 1997). Typically, reading accuracy for this test is high (the mean number of errors was below 1 for all four grade levels), thus, the main criterion is reading speed. In each grade level, a few extremely slow readers caused considerable distortions of the mean percentile scores, and thus Table 3 presents the median percentile scores as well as the quartiles. In general, the children of our German sample showed age equivalent reading development.

Procedure. Nonwords/Number words/Numerals: This task was performed in the same way as in Study 1. For the two youngest groups of English Grade 1 readers the procedure was slightly simplified. Here, the conditions were presented in a fixed order (numerals, number words, nonwords) and the practice sheets were given immediately before each condition.

Results

Nonword reading. Children's nonword reading accuracy was scored according to the lenient criterion described in Study 1, that is all pronunciations that were based on an acceptable grapheme-phoneme translation, irrespective of graphemic context, were counted as correct. Table 4 presents the numbers of errors (upper section) and the reading times (lower section) for the nonword condition of the nonword/number word/numeral reading task.

Table 4
Errors and reading times/items (in s) for the nonword condition

	English standard	English phonics	German
		Errors	
Grade 1 *M (SD)*	17.9 (11.8)	15.3 (6.7)	4.3 (4.5)
Md	16.5	14.0	3.0
Grade 2 *M (SD)*	10.4 (11.7)	8.3 (7.8)	4.6 (3.4)
Md	4.0	6.5	4.0
Grade 3 *M (SD)*	10.0 (10.4)	2.6 (4.0)	5.0 (5.5)
Md	6.0	1.0	3.0
Grade 4 *M (SD)*	4.2 (5.5)	2.8 (3.4)	4.0 (5.6)
Md	2.0	1.5	3.0
		Time/Item in s	
Grade 1 *M (SD)*	3.18 (1.86)	4.92 (2.35)	2.39 (1.66)
Md	2.63	4.36	1.69
Grade 2 *M (SD)*	1.80 (1.32)	2.09 (1.49)	1.58 (0.66)
Md	1.19	1.49	1.53
Grade 3 *M (SD)*	1.90 (1.29)	1.26 (0.72)	1.44 (0.87)
Md	1.49	1.04	1.19
Grade 4 *M (SD)*	1.05 (0.59)	1.06 (0.34)	1.26 (0.52)
Md	0.95	1.06	1.16

In a first ANOVA, the two English groups who differed in instruction method were compared and in a second ANOVA, the English phonics group was compared with the German children who receive a comparable instruction method but acquire a different orthography. In a grade level (4) x group (2) ANOVA comparing the English standard and English phonics children, both, group and grade level showed significant effects ($F(1,186)=6.9$, $p=.009$ and $F(3,186)=10.5$, $p<.001$), while the interaction was unreliable ($F(3,186)=1.0$, $p>.1$). Table 4 shows that in all four grade levels, the mean number of errors is lower for the English phonics than for the English standard group and that there is a remarkable decrease in nonword reading errors from Grade 1 to Grade 4 for both English groups. Individual comparisons separately for each grade level showed that only in Grade 3 the difference between the two groups was reliable ($t(49)=3.0$, $p=.004$). The median scores in Table 4 show that especially among the second graders of the English standard group, there are many children who are unexpectedly competent decoders.

In the second ANOVA comparing the English phonics groups with the German children, the two main effects of group and grade level were reliable ($F(1,166)=6.2$, $p<.05$ and $F(3,166)=33.6$, $p<.001$) and so was the group x grade level interaction ($F(3,166)=7.7$, $p<.001$). Table 4 shows that with increasing grade level the number of reading errors decreases remarkably for the English phonics, but not for the German group. In Grades 1 and 2 the English phonics children commit considerably more errors than the German group. In Grades 3 and 4, the pattern is reversed: The number of reading errors is in fact somewhat lower for English phonics than for German children. Individual comparisons separately for each grade level proved only the differences in Grades 1 and 2 to be reliable ($t(43)=6.6$, $p<.001$ and $t(48)=2.2$, $p<.05$).

The influence of different instruction methods should be most evident in the first stages of reading acquisition. However, both English Grade 1 groups show equally high numbers of errors compared to the German group. But differences in reading abilities could still be reflected in the kind of reading errors. One could expect that children who receive a reading instruction that among other strategies teaches look-and-say might be more prone to reading errors resulting in existing words than children who are consistently encouraged to sound out unknown grapheme sequences. In the present study, however, there is no evidence for such a difference. The percentage of reading errors resulting in existing words was equally low for the Grade 1 children of the English standard and the English phonics group (27 vs. 29%). The generally low number of word responses in both groups is probably due to the clear instruction that the presented nonwords were "made up" and "have no meaning".

There is one obvious reflection of differences in phonological coding abilities in Grade 1. Although the children were heavily encouraged to produce a reading attempt for every nonword, they were not always able to do so. But while the children of the English standard first graders gave no response for 7.8% of all items, the corresponding percentage of the English phonics group was only 1.7%. An error type that occurred sometimes (1.2% of all items) among the English phonics children but not among the children of the standard group was that they translated the graphemes of the presented nonword correctly into phonemes but did not blend these sounds into a coherent pronunciation. Among the German first graders, neither no responses nor naming of the sounds without blending occurred. Their reading errors typically were words or nonwords that deviated from the presented grapheme seqeunce in one or two phonemes (e.g., "ein" or "fei" for *nei*).

The lower section of Table 4 shows that with respect to nonword reading times[2], both the mean scores and the standard deviations of the first graders of all three groups were considerably higher than those of the higher grades, thus, they were analysed separately. English phonics first graders read the nonwords extremely slowly with more than 4s per item. Their reading time is significantly higher than that of both English standard and German first graders ($t(40)=3.4$ and $t(42)=5.2$, $p<.01$ for log-transformed reading times). English phonics children's low reading speed is caused by the strategy of sounding out that these children were taught, that is to name the sounds before blending.

From Grade 2 onwards, the differences between the three groups were rather small. Two group x grade level ANOVAs with log-transformed reading times as dependent variable comparing English phonics children separately with English standard and German children were calculated. In the first ANOVA comparing the two English groups, there was no significant group effect ($F(1,148)=0.3$, $p>.1$). The effect of grade level was reliable ($F(2,148)=11.7$, $p<.001$) and the group x grade level interaction approached significance ($F(2,148)=3.0$, $p=.052$). Individual comparisons separately for each grade level showed that only the reading times of the Grade 3 groups differed reliably ($t(49)=2.1$, $p<.05$). Table 4 shows that the Grade 2 children of the standard group performed surprisingly well. Their reading time was not only comparable with that of the English phonics group, but also with that of their German counterparts ($t(51)=0.2$, $p>.1$). English standard second graders' reading time was in fact slightly lower than that of the third graders of the same group.

In the second group x grade level ANOVA comparing English phonics and German children, the group effect was also unreliable ($F(1,139)=0.4$, $p>.1$), as was the group x grade level interaction ($F(2,139)=2.4$, $p>.05$). Only the effect of grade level was highly reliable ($F(2,139)=10.8$, $p<.001$).

To sum up, in general English phonics children's nonword reading accuracy was once again higher than that of the English standard group, but lower than German children's. However, the main difference between the two English groups was in Grade 3. In Grade 1, both groups of English children committed high numbers of errors, and in Grades 2 and 4 the difference was comparably small because the English standard children performed almost as well as the English phonics children. English phonics children made more errors than German children in the two lower grades, but slightly fewer in the two higher grades. The nonword reading times for the three groups of children were comparable in Grades 2, 3 and 4. Only in Grade 1 the English phonics children read the nonwords considerably more slowly than either English standard or German children.

Number word and numeral reading. On average, the English phonics first graders produced a higher number of incorrect number word readings than the first graders of the English standard group ($M=7.4$, $SD=8.6$ vs. $M=3.9$, $SD=6.3$). However, because of the high variances in both groups, this difference was not significant (Mann-Whitney Test: $Z=-0.6$, $p>.1$). For both groups, almost half of the incorrect readings (45 and 49%) were existing words, typically different number words which most often started with the same letter (e.g., "five" instead of *four*, "two", "ten" or "twenty" instead of *twelve*). If the English standard first graders could not come up with an existing word, they gave no response at all. Only one out of 112 incorrect readings of this group was a nonword pronunciation that could be interpreted as an attempt of sounding out (/dɑ̊/ for two). For the English phonics first graders on the other hand, only 13% of the errors were of the no response type while 42% of the incorrect readings resulted in nonword pronunciations pointing to an unsuccessful attempt to sound out the word. One fourth of these sounding out attempts were in fact results of a phonologically acceptable grapheme-phoneme translation (e.g., /two/ for *two*, /faur/ for *four* or /nini/ for *nine*).

Only one German first grader had considerable problems to read the number words, reading 16 of the 36 number words incorrectly. One child misread all four occurrences of the number word *sechs* (Engl.: six) as "sechen", a nonword. Two further children committed two reading errors and four children made one error each. With the exception of six word pronunciations, all incorrect readings were nonword pronunciations which obviously resulted from a faulty decoding procedure (e.g., "zwehn" for zehn or "dere" for drei). From Grade 2 onwards, reading accuracy for number words was very high for all three groups[3]. The numerals were also read with high accuracy[4].

The main question with respect to reading times for number words and numerals is once again, if any differences in nonword reading between the three groups can be reduced to differences in general naming or articulation speed. Statistical analysis showed that this was not the case. In a group (English standard, English phonics, German) x grade level (Grades 1 to 4) x condition (number words, numerals) ANOVA there was no group effect ($F(2,279)=0.6$,

$p>.1$) and none of the interactions involving group was reliable ($F(2,279)=0.5$, $Fs(6,279)=1.1$ and 1.6, $p>.1$ for group x condition, group x grade level and group x condition x grade level, respectively).

General discussion

In Study 1 it was found that seven-, eight-, and nine-year old English children receiving phonics reading instruction performed reliably better on a nonword reading task than age equivalent groups of English children receiving a mixed teaching approach combining phonics and whole-word strategies. In fact, English phonics children's nonword reading accuracy was as high as that of German children who acquire an orthography with highly consistent grapheme-phoneme correspondences. However, lower nonword reading speed in English phonics compared to German children (especially in the youngest group) shows that the inconsistency of English orthography does pose an additional problem.

In Study 2 we aimed to replicate these findings under better controlled conditions and to explore the performance of even younger children in Grade 1. The results are largely in line with Study 1. In Grades 1 and 2 German children outperformed both English standard and English phonics children. In Grade 1, both reading accuracy and reading speed was reliably higher in the German than in the two English samples, in Grade 2 the difference was already much smaller and in contrast to Study 1 where a difference was observed in reading speed but not accuracy, this time the difference in favour of the German children was in reading accuracy, but not in reading speed. In the higher grades, nonword reading accuracy was rather similar in the three groups. English phonics 3rd graders read the nonwords reliably faster than the English standard 3rd graders, but with equal speed as the German group. In Grade 4 the level of performance was comparable for the three groups.

In the first section of the Discussion, the similarities and differences between the two studies will be reviewed. The performance of both, English phonics and German children were similar in the two studies. The German groups of seven-, eight- and nine-year olds of Study 1 were tested at the beginning of Grades 2, 3 and 4. In Study 2, the German children were tested at the end of the school year, and thus the corrsponding groups are the children in Grades 1, 2, and 3. Both, error scores and reading times for nonwords are similar. German children's performance is not only consistent over the two studies but also corresponds with other empirical research in our lab (Frith et al., 1998; Landerl et al., 1997; Wimmer, 1993).

The English children were tested at about the same time of the schoolyear in the two studies. The 2nd graders of the phonics group in Study 2 showed a higher number of nonword reading errors than the corresponding group in Study 1, but in Grades 3 and 4, these children once again showed very high accuracy for nonwords. In Study 2 they made in fact fewer errors than the German children of the same grade levels. This difference may have to do with the lenient scoring applied for the English children. While the German children in order to be correct had to generate one specific pronunciation resulting from the only posssible grapheme-phoneme translation, several different pronunciations were counted as correct for the English children. The reading speed of the phonics sample of Study 1 was generally somewhat lower than that of the sample of Study 2.

The main difference between the two studies was between the two samples of English standard children. The English standard sample of Study 2 performed exceptionally well, especially the Grade 2 group, whose reading age was in fact as high as that of the Grade 3 children. Although a number of children in Study 2 showed poor decoding abilities and caused considerable distortions of the mean scores for nonword reading errors, the majority of children were good decoders so that from Grade 2 onwards their median error scores were barely higher than those of the corresponding German groups. This difference can only partly be explained by different scorings used in the two studies. While Wimmer and Goswami (1994) counted as correct only pronunciations that had a real word analogue, all pronunciations that

were based on plausible grapheme-phoneme translations were accepted in Study 2. However, in Study 1 both scorings were done for the English phonics group and the difference was rather small. Furthermore, the English standard children of Study 2 showed not only high accuracy for nonwords, but also remarkably high nonword reading speed. The median reading time of the Grade 2 children was even lower than that of the English phonics and the German children.

This good performance of the English standard sample stands in marked contrast not only to the findings in Study 1, but also to several other studies assessing nonword reading abilities of young English readers. The findings of the present study are probably best compared with other studies in which nonwords consisting of familiar onsets and rimes were used. Landerl (1996) presented the nonword/number word/numeral reading task to a group of 21 eight- to nine-year old readers and found a mean error score of 8.3 and a mean reading time of 1.7s per item for the nonword condition. Frith et al. (1998) report about 54, 45 and still 23% errors for seven-, eight- and nine-year old English children on a continuous list of one- and two syllable nonwords and a very low mean reading speed of 4.1s per item. On a single item presentation task, a sample of eight-year old English children committed about 23% errors on one- and two syllable nonwords with naming latencies between 2.3 and 3s. It is important to note that in both studies a very lenient scoring criterion was applied for English children's nonword reading attempts. Considerable differences between different samples on the same nonword reading task are obviously not untypical for English. Goswami et al. (1998) used the same list of nonwords with familiar rime units (e.g., *dake*) in two studies. In Study 1, groups of English children with reading ages of seven, eight, and nine years read 56, 64 and 92% of the monosyllabic items correctly, but in Study 3 reading accuracy was considerably lower with 29, 66 and 60% correct readings for groups with equivalent reading ages. Thus, we are left with the disconcerting conclusion that in English schools one can find enormous variablity in decoding abilities and that there was a high number of exceptionally good decoders among the present English standard sample tested in Study 2. Possible reasons are higher social background of the participants or higher parental support.

In Study 2, children who had received only one year of reading instruction were included. The expectation was that differences between instruction methods would be most evident in the first stages of reading development. This could, however, not be confirmed. In the nonword reading condition the English phonics children produced only slightly but not reliably less errors than the English standard children (15.3 vs. 17.9 errors). The influence of orthographic consistency on the other hand is most evident for the youngest group with only 4.3 errors for the German sample. Furthermore, English phonics children's mean reading time was considerably higher than that of both the English standard and the German children. The reason for English phonics children's low reading speed is that they were taught to name the sounds of a presented spelling and then blend these sounds into a coherent pronunciation (e.g., /sə/-/e/-/nə/-/sen/). This strategy obviously leads to a very low reading speed, but is successful at least for short, one-syllable items. For the somewhat longer items, the children especially of the Grade 1 group sometimes found it difficult to keep all the sounds in working memory. Typical errors for the two-syllable nonword *feven* were to reduce the item to a one-syllable pronunciation (/ven/ or /fen/). Another way to perform phonological coding which is typically applied by young German readers, is to blend the sounds successively in a left-to-right fashion. An extreme example of such a successive decoding that might be observed for children in their very first stages of reading acquisition would be /tsə/-/tswə/-/tswe:/-/tswe:n/ for *zwehn*. In this variant of the blending procedure, memory load is considerably smaller because it does not require to store a sequence of unconnected sounds but only the output of the blending procedure that has been performed so far.

In the number word condition, English phonics children's reliance on their phonological coding abilities had a negative influence because the Grade 1 children had difficulties with the irregular and inconsistent number words like *two* or *four*. Interestingly, both, groups of English first graders applied a strategy of partial phonological coding, that is, they decoded the first one or two letters of an item and then searched their mental lexicon for a number word starting with these letters (e.g., "twenty" instead of *twelve*). Such a partial phonological decoding strategy

supplied by semantic information is perhaps quite efficient in a deep orthography like English and is applied even by children who are consistently encouraged to sound out unknown words. When one comes across an inconsistent or irregular word spelling, contextual cues must be used to disambiguate the phonological information given by the graphemic code.

German first graders' accuracy for number words was considerably higher than that of both English groups and a strategy of partial phonological coding could not be observed. Only six reading errors of this group resulted in existing words and only one of these words was actually another number word ("17" for *seven*). Typically, the reading errors of the German children resulted in nonword pronunciations resulting from a faulty phonological decoding procedure. Thus, in contrast to the two English groups' partial decoding, the German first graders probably decoded the whole grapheme sequence. Because of the high consistency of German orthography, this decoding process most often resulted in the correct number word pronunciation.

The pattern of performance found for the English phonics first graders could actually be replicated when we performed the nonword/number word/numeral reading task with a classroom of first graders (N=26) from a Scottish school that also adheres to a straightforward phonics teaching regime[5]. These children too showed high error scores (M=14.1) and low reading speed for the nonwords (M=4.5s) and also comparably low reading speed for the number words (M=2.0s). There were no reliable differences between this additional Scottish sample and the Grade 1 phonics sample reported in the present study indicating that the difficulties with the blending procedure observed in the present study are not untypical for phonics taught children in the first stages of their reading development.

A major difference between the two English groups on the one hand and the German group on the other hand that can certainly not be ignored is age. Children in all three groups were selected so that they had received one, two, three and four years of formal reading instruction. Due to differences in age of school entry in the UK and Austria, however, the children of the German group were between one and two years older than their English counterparts. It is important to note that differences in phonological coding abilities cannot generally be reduced to age differences. In Study 1, English and German children were of comparable age and the German groups were in fact disadvantaged with respect to the length of their formal reading instruction, but they nevertheless showed better decoding abilities. In Study 2, German first graders and English second graders were the same age, but despite of their comparably low reading experience, the German first graders commited only 4.3 errors on average while the mean error scores of the English standard and English phonics second graders were considerably higher with 10.4 and 8.3.

But at least for the English Grade 1 children who on average had just turned six, it has to be acknowledged that their general cognitive as well as their linguistic development is clearly less advanced than that of the German first graders who are more than a year older. In the testing situation, some of the English first graders had obvious difficulties to understand that they were supposed to read as quickly as possible. Some children started to talk in the middle of a reading sheet, others looked at the experimenter for confirmation after every item and a fair number of children had difficulties in keeping to the line and had to be supported by the experimenter. Reading instruction in the phonics school progressed quite fast (for example, the 40 most important grapheme-phoneme correspondences are introduced within the first three months of the reception year, that is around children's fifth birthday) and it might well be that at least some children were overcharged.

Generally, our findings are in line with other research showing that a phonics approach is an efficient way to teach normal (Adams, 1990; Bruck et al., 1998; Byrne, 1998; Watson & Johnstson, 1997) as well as delayed readers (Foorman, Francis, Winicates, Mehta, Schatschneider, & Fletcher, 1997). In fact, we put the hypothesis that phonics teaching is the most efficient teaching approach to a rather hard test because the children of the English standard group had received phonics teaching as well. According to their teachers, they had a phonics lesson once a week following the requirements of the British national curriculum. However, the findings of the present study demonstrate that differences between English and German readers

cannot only be attributed to differences in reading instruction, but that differences in orthographic structure have an important influence. In German orthography, grapheme-phoneme correspondences are highly consistent and reliable so that the young reader has many successful experiences if he applies the process of phonological coding. As soon as children know the comparably simple alphabetic code and are capable of performing the process of phonological assembly, they are able to read more or less every word, though slowly and laboriously at the beginning, but successfully. The young English reader, on the other hand, even if he knows the highly complex code and applies the process of phonological coding correctly, will still have many negative experiences with the many inconsistent and irregular spellings of English orthogaphy.

There might actually be an interaction between orthographic consistency and reading instruction. More specifically, it might be the case that in an inconsistent orthography like English phonics teaching is important to help children to understand how print maps on to spoken language, while in consistent orthographies the orthographic structure by itself provides enough clear and unequivocal information about the relationship between spoken and written language to set off children's phonological decoding abilities even if they receive a whole word instruction. A recent study by Leybaert and Content (1995) comparing French speaking children receiving phonics vs. whole word teaching provides some evidence that there is such an interaction. Leybaert and Content found that Grade 2 children who received whole word teaching in general were slower and made more errors for words as well as nonwords than children taught via a phonics approach. Paradoxically, however, the whole-word children did not appear to rely more on whole-word knowledge than phonics children. On the contrary, they tended to use analytical correspondences to a greater extent than the phonics group, although their knowledge of these correspondences was poorer and less accurate. In later development (Grades 4 and 6), no relevant differences were found between the two groups. It seems that these French whole-word children were trying hard to work out the alphabetic code by themselves, in spite of the teaching approach they received. On the continuum of orthographic consistency, French lies somewhere between English and German. Perhaps cracking the alphabetic code without explicit teaching of this code is easier the more consistent an orthography is and gets more and more difficult the more inconsistent an orthography is. This would mean that the deeper and more intransparent the orthography, the more important explicit information about the correspondences between spoken and written words might be. The crux is that it is much more difficult to provide such a systematic and well-structured phonics teaching approach in the highly complex English orthography than in most other orthographies.

Appendix 1

Items of the nonword reading conditions and pronunciations that were counted as correct

	English		
Item: English/German	Strict Scoring	Lenient Scoring	German
nee/nei	/ni:/	/nə/	/nai/
thrine/dreun	/θrain/, /θrin/	/θri:n/, /θrini/, /θrinə/	/droin/
feven/zieben	/fevən/	/fivən/, /fi:vən/	/tsi:bən/
nour/zwier	/no:r/, /nauə/, /nau/		/tswi:ə/
twive/sünf	/twaiv/, /twiv/	/twi:v/, /twivi/, /twivə/, /twaivi/, /twəvi/	/synf/
felve/sölf	/felv/	/felvi/, /felvə/	/sœlf/
thro/fei	/θru:/, /θrou/	/θro/	/fai/
sen/zwehn	/sen/	/si:n/, /sin/	/tswe:n/
tix/vechs	/tiks/		/feks/, /veχs/

Notes

1 Seven children of the phonics group misread one of the numerals and seven children made errors in reading the number words, the number of errors ranging from one to five. No child of the English standard group made errors in reading the numerals and seven children made errors in reading the number words, the number of errors ranging from 2 to 16. Four German children made one error and one child made two errors in the numeral condition. In the number word condition, six German children made a single error and one child made two. Mann-Whitney U tests showed that only the difference between the English phonics and English standard groups for numeral naming was reliable (Z(corrected for ties)=-2.6, $p<.01$).

2 The nonword reading times of three first graders could not be used. One child of the English standard group responded with "don't know" to all items of the first sheet and was not presented with the second sheet. Another child of this group had an unrealistic score of over 5min for a sheet for which he mainly gave "don't know" responses. One girl of the English phonics group started talking in the middle of a nonword reading sheet.

3 The mean scores of errors were 1.0 (SD=3.1) and 1.3 (SD=3.7) for English standard and English phonics second graders and 2.0 (SD=4.0) and 0.5 (SD=0.2) for the third graders. In Grade 4, none of the children of the two English groups made a mistake. The German children were errorless in Grade 2, in Grade 3 one child made two errors and another child had one error and in Grade 4 one reading error occurred.

4 Among the English standard group, one first grader made four errors, two first graders made one error each, one fourth grader made two mistakes and another fourth grade child committed one error. Three first graders of the English phonics group made one error each, a second grader made two mistakes and two third grade and two fourth grade children commited one error each. Finally, two first graders and three fourth graders of the German group made one error each.

5 We are grateful to Joyce Watson for providing these data.

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Wimmer et Goswami rapportent que des enfants anglais de sept, huit et neuf ans ont beaucoup plus de difficultés avec une tâche de lecture de mots sans signification que des enfants allemands qui l'orthographe avec une méthode de correspondance grapho-phonologique. Dans la première étude, des enfants englais de 7, 8 et 9 ans bénéficiant d'un apprentissage phonologique ont été confrontés à la même tâche et comparés aux enfants testés par Wimmer et Goswami. La seconde étude est une réplication avec différents échantillons d'enfants anglais bénéficiant de l'approche standard combinant des stratégies de mots complets et des stratégies phonologiques, d'enfants anglais bénéficiant d'un enseignement phonologique et d'enfants formés avec des méthodes phonologiques et qui acquièrent une orthographe consistante. Les enfants qui ont été testés sont des enfants allant de la première à la quatrième années scolaires. Dans les deux études, les enfants anglais "phonologiques" ont lu les mots sans signification avec presque la même précision et la même vitesse que les enfants allemands. Dans la première étude, les enfants anglais "phonologiques" ont performé nettement mieux en lecture des mots sans signification que les enfants de l'échantillon standard. Dans la seconde étude, la différence a éte aussi évidente mais cependant moins marquée. En première année, les enfants anglais "phonologiques" aussi bien que les enfants anglais standards ont eu nettement plus de difficultés avec le décodage pnonologique que les enfants allemands, ce qui témoigne d'une influence pertinente de la consistance orthographique.

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