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Dysfluent Reading in the Absence of Spelling Difficulties: A Specific Disability in Regular Orthographies

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Two large studies identified substantial numbers of German-speaking children (Grade 3) with marked dissociations between reading and spelling difficulties. These dissociations were expected because German exhibits high regularity in the direction of graphemes to phonemes (forward regularity) but not in the direction of phonemes to graphemes (backward regularity). High forward regularity allows reliance on phonological processing in reading (even in advanced fluent reading), whereas low backward regularity requires reliance on orthographic memory representations in spelling. Dysfluent reading in the absence of spelling difficulties was associated only with a naming speed deficit—assessed at school entrance—but not with phonological memory or phonological awareness deficits. In contrast, a specific spelling deficit was preceded by phonological deficits.

In orthographies with regular grapheme–phoneme relations, difficulties in learning to read take another form than they do in English. In English, the typical problem of children who are dyslexic is to read correctly unfamiliar words, whereas in more regular orthographies, the typical problem is to read fluently. To illustrate, in Landerl, Wimmer, and Frith's (1997) comparative study, a majority of the 11-year-old English children who were dyslexic had a problem with the word *character*. Some children refused to read it and others produced misreadings ranging from *chancelor* and *calendar* to nonwords such as *tshraekter*. In contrast, the German children who were dyslexic for the close to identical word *Charakter* produced few misreadings (all nonwords), but their reading time was between 2 and 3 times higher than that of their peers who read normally. The massive reading fluency impairment of German children who were dyslexic in the context of relatively few errors (even under speed instruction) has been obtained in several studies (Klicpera & Schabmann, 1993; Landerl, Wimmer, & Frith, 1997; Wimmer, 1993, 1996; Wimmer, Mayringer, & Landerl, 1998). Similar findings have been reported for children who were dyslexic in other more regular orthographies, such as Spanish (Gonzalez & Valle, 2000), Italian (Zoccolotti, de Luca, di Pace, Judica, Orlandi, & Spinelli, 1999), Norwegian (Lundberg & Hoien, 1990), and Dutch (Van den Bos, 1998; Yap & Van der Leij, 1993).

One explanation of the typical dysfluency problem in regular orthographies would be that these children suffer from surface dyslexia, as formulated in recent subtyping approaches (Castles & Coltheart, 1993; Manis, Seidenberg, Doi, McBride-Chang, & Petersen, 1996; Seymour, 1986; Stanovich, Siegel, & Gottardo, 1997). According to this explanation, these children suffer from a specific impairment to form memory representations of frequently read words. Therefore, they cannot rely on fast visual word recognition even in the case of frequent words and have to rely on slow phonological processing (e.g., grapheme–phoneme based) instead.

The problem of this explanatory account is that German children who were dyslexic were found to be as fluency impaired or even more fluency impaired in their reading of pseudowords than in their reading of high-frequency words (Landerl, Wimmer, & Frith, 1997; Wimmer, 1993, 1996). Because this fluency impaired reading of pseudowords was found for items with little similarity to existing words and and because of high correlations of about .80 between reading time for pseudowords and reading time for high-frequency words, Wimmer (1993) used the term *phonological speed dyslexia* to characterize the proximal reading difficulty of children who are dyslexic in regular orthographies. The idea was that, in regular orthographies, particularly when initial teaching is based on synthetic phonics, the main stumbling block for children who are dyslexic is to progress from slow sequential, grapheme–phoneme based word decoding to fast parallel, effortless phonological processing.

In the present study, we examined a further implication of the phonological speed account of dyslexia. If indeed reading fluency is more a matter of phonological efficiency in word processing and has little to do with orthographic memory representations, then dysfluent readers would not necessarily suffer from a spelling problem. Such a dissociation would mean that these children form memory representations of word spellings at an appropriate rate, but these memory representations are not used for fast visual word recognition. Such a combination of dysfluent reading, but unimpaired spelling, would provide further confirmation for the phonological speed account of dyslexia.

However, first to be clarified is how spelling problems can occur in an orthography such as German, which is characterized as regular. The answer is that regularity refers to grapheme–phoneme (forward regularity) but not to phoneme–grapheme (backward regularity) relations. An asymmetry between forward and backward regularity is typical for many alphabetic orthographies and is

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the reason why, in general, reading is easier than spelling (Bosman & Van Orden, 1997). Formal counts of asymmetric forward and backward relationship of orthographies have used body–rime consistency and not grapheme–phoneme regularity. For English, on average, 70% of monosyllabic words were found to be forward consistent in the direction from spelling body to rime, whereas only about 28% are consistent in the direction from phonology to spellings (Ziegler, Stone, & Jacobs, 1997). For German monosyllabic words, a similar asymmetry at a higher consistency level was found, with 84% of all words forward consistent, but only 47% backward consistent (J. Ziegler, personal communication, February 20, 2001).

German's low backward regularity has the effect that, in contrast to reading, a phonetic approach is not encouraged for writing in German schools. "Write it as you hear it" is considered bad advice. Spelling instruction to some extent is based on rote learning of specific spellings. Regularities are demonstrated by word families sharing syllables, rhymes, or onsets, and considerations of morpheme constancy play a major role in spelling instruction. Spelling is a major focus of teaching for several years in school, and children's progress is frequently checked. In contrast, systematic reading instruction of the synthetic phonics type takes place in the first year in school, and then children are expected to gain fluency by practice.

As already noted, in the German context, marked dissociations between dysfluent reading, but unimpaired spelling, are to be expected when children have specific difficulties progressing from slow sequential to fast parallel phonological processing in reading. Such a dissociation is of interest, inasmuch as in English-based research on dissociations, mainly the combination of poor spelling in the absence of reading difficulties, has received attention (e.g., Frith, 1980). This dissociation is mentioned as a specific learning difficulty in the 4th edition of the *Diagnostic and Statistical Manual of Mental Disorders (DSM–IV)* of the American Psychiatric Association (1994) and in the *ICD-10 Classification of Mental and Behavioural Disorders* of the World Health Organization (1992). To our knowledge, there is only one study that has already noted our expected dissociation between dysfluent reading and unimpaired spelling; and, ironically, it was done with English children. Lovett (1987) tested reading rate deficits among children referred for remedial instruction. Among these referrals, Lovett found a group of children whose only problem was slow dysfluent reading and not errors. This group had no reliable spelling deficits. On a variety of oral language tests, they tended to perform better than fluent reading peers. Their only marked deficit was on visual, rapid "automatized" naming tests, which require the sequential naming of a number of repeatedly presented pictured objects, colors, digits, and letters. Visual naming deficits have also been found to be the main deficit of both German (Wimmer, 1993; Wimmer et al., 1998) and Dutch children who are dyslexic (Van den Bos, 1998).

In the present study, we used reading and spelling measures from two large longitudinal studies to examine the expected dissociation between dysfluent reading and unimpaired spelling and the converse dissociation between poor spelling and unimpaired reading fluency. In Study 1, the reading and spelling measures were taken at the end of Grade 3, and in Study 2, in the first months of Grade 4. At this time in their school career, German children are supposed to read age-appropriate books and already have received a large dose of spelling instruction. Therefore, at this time, serious deficits of reading fluency and spelling should be obvious. A further goal in the present study was to examine precursors of single reading fluency deficits and of single spelling deficits. If indeed these deficits constitute different learning disabilities, then different cognitive deficits should precede the expected dissociations. In previous work using these data (Wimmer, Mayringer, & Landerl, 2000) we distinguished—based on school entrance measures—between a single phonological awareness deficit, a single rapid naming deficit, and a double deficit, consistent with Wolf and Bower's (1999) subtyping proposal. Three years later, the single phonological awareness deficit group exhibited only a spelling, but no reading fluency, problem. In contrast, the single naming deficit and the double-deficit children exhibited both a fluency and a spelling problem. Thus, Wimmer et al.'s (2000) study was not informative on the expected occurrence of dysfluent reading in the absence of a spelling deficit. Studies 1 and 2, presented here, are similar with respect to the longitudinal design and the measures used. Furthermore, the definition of dissociations between reading fluency and spelling problems was identical in both studies. Therefore, we present both studies conjointly in the *Method* and in the *Result* sections.

Method

Participants and Overview of Procedure

Study 1 included 530 German-speaking Austrian boys. The assessment of precursors of reading and spelling difficulties was done in the first 2 months of Grade 1 (September and October 1994). The assessment of reading and spelling on which the dissociations are based was done at the end of Grade 3 (May and June 1997). The sample involved 31 schools and 74 classrooms in the city of Salzburg and in neighboring communities. Study 2 was also done in and around the city of Salzburg and included 296 children (153 boys) and again assessed children in the first months of Grade 1 (September and October 1996) and tested reading and spelling in the first months of Grade 4 (September and October 1999). In Austria, children begin school the autumn after their 6th birthday. There is no reading preparation involving letters in kindergarten in German-speaking countries, so that the prescursor assessment at the beginning of Grade 1 can hardly reflect differences in reading ability.

Reading and Spelling Deficits

Reading fluency. For the reading fluency assessment of both Studies 1 and 2, children had to read aloud a short story and word lists from a reading test battery developed in our laboratory (Landerl, Wimmer, & Moser, 1997). Each subtest required reading aloud a single page containing several lines of reading material, with the instruction to read aloud as quickly and accurately as possible. The story (57 words) was of simple content, so that reading time should not have been affected by comprehension difficulties. In Study 1, children also read a list consisting of 30 short, high-frequency content words such as *Vater* (father) or *Milch* (milk) and a list consisting of 11 long compound words such as *Fruchtsaft* (fruit juice) or *Wohnzimmer* (living room) with the compounds again existing of high-frequency words. In Study 2, children, in addition to the story, read two lists of compound words. For each page, errors and reading time were recorded. A composite syllables-per-minute score, based on all three subtests, was used for reading fluency. This syllable rate measure more easily translates into an impression of fluency. Errors were not taken into account, as reading accuracy was close to ceiling. Furthermore, the few errors that did occur could hardly affect reading time, as nearly all of the errors were minor deviations from the target, such as *Obstsaft* for *Obststand*. In no case did a child refuse to read a word or get stuck on a word. The first step in forming the composite rate score was to compute separate scores for each subtest. Correlations between subtests ranged between .83 and .93. To give about equal weight to word list reading and text reading, we first averaged the reading rates for the two lists and then averaged list reading rate and text reading rate.

Pseudoword reading. Here the same continuous list-reading format was used as for the assessment of reading fluency. The 24 items of the pseudoword list in Study 1 always consisted of two or three simple syllables without any consonant clusters; examples are *Heleki* and *Tarulo*. The 22 pseudoword items used for Study 2 were intended to be more difficult and always consisted of two syllables, with a cluster at the beginning and a cluster at the end of the word; examples are *Knepolt* and *Dranibst*. Both types of pseudowords have little similarity with existing German words. In both studies, syllables per minute was used for reading fluency and percentage of correctly read words was used for accuracy.

Spelling. In Study 1, we used a standardized classroom spelling test (Landerl, Wimmer, & Moser, 1997) consisting of 49 words. In Study 2, we used a newly developed classroom spelling test (35 words), which was similar to that of Study 1 but was intended to be more difficult. The words of both tests were chosen in such a way that simple phoneme–grapheme transcriptions would not result in correct spellings. For example, *kommt* (comes) resulted in the misspellings *komt*, *komd*, *gomd*, *kohmmt*, *kom*, and *kont*. *Häuser* (houses) was misspelled as *Heuser*, *Heusa*, *Hoiser*, *Häser*, and *Heiser*. Quite a few of the misspellings apparently resulted from children's southern Bavarian pronunciations of the dictated words. The spelling score was the percentage of correct conventional spellings (disregarding capitalization errors).

Precursors of Reading and Spelling Deficits

Phonological short-term memory. In both studies, an impairment of phonological short-term memory was assessed with a pseudoword repetition task. The items were always presented by the experimenter. The child had to immediately repeat back what he or she had heard. The pseudoword repetition task of Study 1 required repetition of single pseudowords, which always consisted of three syllables. The difficulty was that the syllables were easily confusable with respect to identity and position of the initial consonant; examples are *bowiba* and *fiwofi*. The task consisted of 15 items. The pseudoword repetition task of Study 2 consisted of 16 items. The first half of the items required repetition of two pseudowords (e.g., *tes–bof*), the second half repetition of three pseudowords (e.g., *gat–fos–hap*). These pseudowords always were consonant, vowel, consonant (CVCs) with a short vowel. Practice items with feedback introduced both tasks.

Phonological awareness. For the assessment of impaired phonological awareness, we had to use simple tasks because of the absence of letter-based reading preparation in kindergarten. In Study 1, rhyme and onset detection were used as phonological awareness measures. Each item of the rhyme detection task (15 items) asked which one of two words rhymed with a target word, for example. "What rhymes with Feld: Geld or Gold?" The onset detection task (16 items) directly specified the critical segment. For the first half, this segment was the initial syllable (e.g., "Tube–Pudel–Kugel: Which one begins with /pu/?"). For the second half, this segment was a consonantal continuant such as /m/ or /f/. To minimize memory demands, the three options were always accompanied by three corresponding pictures.

Study 2 assessed phonological awareness by having children imitate the word divisions provided by the experimenter. The experimenter first explained that words can be divided into smaller parts and demonstrated this with "Fee-/f/-/e/." The child always had to repeat the word and the segments. The idea here was that a child who did not understand the relation between the words and its segments would find the task difficult. The first block of six items used simple words consisting of an initial consonant and a subsequent vowel (CV words). The second block of six items used CVC words.

Visual naming speed. Impaired visual naming speed was assessed by tasks modeled after Denckla and Rudel's (1976) rapid, automatized naming test. In Study 1, we used the combined score from two separate subtests. In each, a random sequence of 20 pictured objects (5 different pictures, each repeated 4 times) had to be named. The words of the first task (all monosyllabic), started with different consonant clusters. Those of the second task started with the same single consonant. In Study 2, the visual naming speed task involved presentation of a random sequence of 32 pictured objects (4 different pictures, each 8 times). We calculated the syllables-per-minute score to allow comparison with reading fluency.

Articulation rate. Only Study 1 assessed articulation rate impairments by having children repeat a word triple as often as possible for 10 s. Two tasks were presented. Each triple consisted of semantically related words: *Hund, Katze, Maus* (dog, cat, mouse) and *Messer*, *Gabel*, *Löffel* (knife, fork, spoon). For a single rate measure (syllables per minute), the two trials were combined.

Visual–motor speed. In Study 1, a speed impairment in the visual–motor domain was also assessed with Annett's (1985) peg-moving task. On each trial, the child has to replace 10 pegs from one line of holes in a wooden frame into the holes of a second line. There were two trials for the right hand and two for the left hand. Time scores for each trial were combined to a pegs-per-minute score.

Nonverbal intelligence. In Study 1, three subscales (Spatial Sequences, Spatial Integration, and Spatial Concepts) of the Primary Test of Cognitive Skills (Huttenlocher & Cohen-Levine, 1990) were administered at the end of Grade 1 as group test. Because no norm data for Austrian children are available, the raw points from each scale were standardized. The sum of the three standardized scales was converted into an IQ scale (M = 100, SD = 15). In Study 2, we used Raven's Colored Progressive Matrices as a group test at the end of Grade 1. Because the German norms are dated, we standardized the scores with the present sample of about 300 children, again centering the score at 100 with an SD of 15.

Results

For both Studies 1 and 2, the same criteria were used for defining dissociations between word reading rate and spelling scores that were substantially correlated in the two samples, rs = .59 and .65 for Studies 1 and 2, respectively. A single fluency deficit was defined by a word reading rate below the 16th percentile, but a spelling score above the 25th percentile. A single spelling deficit was defined conversely: spelling below the 16th percentile and word reading rate above the 25th percentile. The double-deficit group was below the 16th percentile on both measures, and the no-deficit group scored above the 25th percentile on both measures. The percentiles were based on the distribution of the scores in the total samples. The numbers of children in each subgroup for both Study 1 (upper section) and Study 2 (lower section) are recorded in Table 1. In each section first defining and descriptive measures are given. In addition to means and standard deviations, Table 1 includes percentiles that correspond to the means. For example, the mean word reading rate score of the single fluency deficit group (Study 1) corresponds to a percentile of 11 (i.e., only 11% of the 530 children had a lower rate).

Substantial numbers of children in both Studies 1 and 2 exhibited single deficits. In Study 1 (boys only), the number of children with a double deficit was about twice the number of children with a single deficit, whereas in Study 2 (about an equal number of boys and girls), the number of children with a double deficit was about the same as the number of children with a single deficit. As

Table 1
Performance of Subgroups on Reading, Spelling, and Precursor Measures

	No deficit		Single fluency deficit			Single spelling deficit			Double deficit		
Measure	*M*	*SD*	*M*	*SD*	*P*	*M*	*SD*	*P*	*M*	*SD*	*P*
Study 1											
n	415		23			18			42		
Defining and descriptive measures											
Word reading rate (syllables/min)	$165.7_{2,3,4}$	40.6	$84.8_{1,3}$	10.9	11	$134.5_{1,2,4}$	17.2	40	$68.2_{1,3}$	20.0	5
Spelling (% correct)	$83.3_{2,3,4}$	11.7	$74.5_{1,3,4}$	9.0	39	$46.6_{1,2,4}$	6.0	10	$38.7_{1,2,3}$	9.7	5
Age (months)	111.6_{3}	4.6	113.2	5.2		114.8_{1}	6.3		112.8	5.7	
IQ	101.1_{4}	14.5	100.0	13.5		95.3	14.5		95.0_{1}	17.6	
Pseudoword reading											
Rate (syllables/min)	$100.0_{2,4}$	26.4	$61.8_{1,3}$	12.0	12	$97.8_{2,4}$	18.1	61	$57.5_{1,3}$	15.7	10
Accuracy (% correct)	$92.2_{2,4}$	8.6	$84.8_{1,3}$	10.6	29	$90.5_{2,4}$	6.2	44	$82.0_{1,3}$	13.4	22
Phonological and speed deficits											
Phonological memory (% correct)	$69.3_{3,4}$	19.0	$72.8_{3,4}$	19.7	65	$53.7_{1,2}$	21.4	29	$55.1_{1,2}$	19.7	31
Phonological awareness (% correct)	$86.8_{3,4}$	12.1	$86.5_{3,4}$	11.2	49	$73.5_{1,2}$	10.1	21	$76.5_{1,2}$	15.9	28
Rapid naming (syllables/min)	$47.5_{2,4}$	9.6	41.1_{1}	9.1	34	45.2_{4}	8.2	50	$39.1_{1,3}$	8.4	27
Articulation rate (syllables/min)	220.0_{4}	40.5	210.7	26.6	43	219.2_{4}	33.7	53	$197.5_{1,3}$	39.2	32
Visual–motor speed (items/min)	42.8_{2}	4.8	40.4_{1}	4.1	33	42.9	4.9	53	42.1	4.8	46
Study 2											
n	230 (113 boys)		19 (9 boys)			15 (11 boys)			20 (12 boys)		
Defining and descriptive measures											
Word reading rate (syllables/min)	$185.9_{2,3,4}$	36.0	$95.2_{1,3}$	19.6	8	$152.0_{1,2,4}$	13.5	35	$87.4_{1,3}$	17.5	6
Spelling (% correct)	$78.7_{2,3,4}$	11.9	$72.9_{1,3,4}$	8.4	45	$44.8_{1,2}$	4.8	7	$39.3_{1,2}$	12.2	5
Age (months)	122.0_{4}	4.9	123.1	5.5		122.7	4.4		124.8_{1}	5.8	
IQ	102.0_{4}	14.2	97.2	14.5		95.3	17.0		95.3_{1}	12.8	
Pseudoword reading											
Rate (syllables/min)	$54.7_{2,4}$	15.3	$30.2_{1,3}$	9.0	10	$53.6_{2,4}$	14.5	58	$28.8_{1,3}$	7.7	8
Accuracy (% correct)	$80.2_{3,4}$	13.4	79.1_{4}	11.9	53	71.2_{1}	13.0	30	$63.0_{1,2}$	18.1	14
Phonological and speed deficits											
Phonological memory (% correct)	$71.6_{3,4}$	19.3	73.7_{3}	18.1	58	$54.4_{1,2}$	22.0	28	62.1_{1}	23.6	39
Phonological awareness (% correct)	$61.0_{3,4}$	28.5	54.2_{4}	30.4	53	36.4_{1}	23.0	36	$32.7_{1,2}$	23.8	30
Rapid naming (syllables/min)	$57.7_{2,3,4}$	11.5	48.3_{1}	9.8	30	48.9_{1}	6.8	32	46.0_{1}	7.6	22

Note. *P* = percentiles corresponding to means. Group comparisons are based on two-tailed *t* tests. Subscript numbers indicate that the mean differs reliably ($p < .05$) from the referred-to mean: $_{1}$ = no-deficit group; $_{2}$ = fluency-deficit group; $_{3}$ = spelling-deficit group; $_{4}$ = double-deficit group.

expected from the selection procedure, children with a single reading fluency deficit exhibited highly discrepant means for word reading rate and spelling. Word reading rates of these children in both of the studies were only about one half the rates of the no-deficit groups and low in absolute terms, with means of about one and a half syllables per second. In contrast, the mean percentage for correct spellings was either only a few points below that of the no-deficit groups (Study 1) or it was close to identical to that of the no-deficit group (Study 2). Children with a single fluency deficit exhibited nonverbal intelligence scores in the normal range and tended to be slightly older than those in the no-deficit groups. The reading fluency problem of the single fluency deficit groups was not limited to text and word lists, but was of similar size for pseudowords. However, reading accuracy for pseudowords was hardly affected. In Study 1, the mean percentage of correctly read pseudowords was only 7% lower than that of the no-deficit group, and in Study 2 (with more difficult pseudowords), it was close to identical to the percentage of the no-deficit group. On the phonological short-term memory and the phonological awareness tasks, the performance of participants with a single fluency deficit was as high as that of the no-deficit group, and on the naming speed tasks, their performance was reliably lower. Also, only visual–motor speed, but not articulation rate, was impaired in the Study 1 single fluency deficit group.

Children with a single *spelling* deficit exhibited the converse discrepancy on the defining measures than children with a single *fluency* deficit. These children exhibited close to normal word reading rates, but the percentages of correct spellings were low. Nearly all of the misspellings were phonemically plausible (Study 1, 96%; Study 2, 93%). The nonverbal intelligence means tended to be only slightly below average. In Study 1, the pseudoword reading performance of these children was close to identical to that of the no-deficit group. In Study 2, with more difficult pseudowords, accuracy was lower. The main finding, however, was that on the phonological precursor measures, these children consistently scored poorly in both Studies 1 and 2. The results on speed deficit were not fully consistent. In Study 1, the single spelling deficit group on all three speed measures scored close to identical to that of the no-deficit group. In Study 2, naming speed was lower and comparable with the naming speed deficit of the single fluency deficit group.

Children with a deficit in both fluency and spelling had nonverbal intelligence scores slightly below average. Their pseudoword reading corresponded to that of the single fluency deficit group, and on the precursor measures, they exhibited both phonological and speed deficits.

The correlational patterns for the total samples in Study 1 (n = 530) and in Study 2 (n = 296) were largely consistent with the group differences in Table 1. Word reading rate was highly associated with pseudoword reading rate (Study 1, r = .77; Study 2, r = .78). It was moderately associated with naming speed (Study 1, r = .39; Study 2, r = .42) and less substantially associated with the phonological measures and the other speed measures of Study 1 (all rs < .25). There were moderate associations between spelling and phonological measures rs between .45 (phonological awareness, Study 2) and .30 (phonological memory, Study 2). Associations between naming speed and spelling were .27 and .29 in Studies 1 and 2, respectively.

Discussion

The findings of the present study confirm the expected dissociations between reading fluency deficits and spelling deficits in an orthography with high forward but low backward regularity. In such an environment, reading was assumed to be strongly phonologically driven and to progress from slow sequential to fast parallel phonological processing. In contrast, spelling was assumed to rely on orthographic word representations. Of particular interest was the occurrence of severely dysfluent reading in the absence of spelling difficulties. This dissociation is theoretically interesting as it implies that children store orthographic memory representations at an appropriate rate and use them for spelling but not for reading.

The interesting pattern of dysfluent reading in the absence of spelling difficulties was indeed found in a substantial number of children, that is, in about 4% and 6% of the total samples of Studies 1 and 2, respectively. Most important, however, these children with a single reading fluency deficit did not exhibit any deficits of phonological short-term memory and of phonological awareness in the school entrance assessment. Their only deficit was with respect to speed. In particular, visual rapid naming was affected, consistent with similar deficits in German children with dyslexia (Wimmer, 1993; Wimmer et al., 1998, 2000). The present findings are also consistent with Lovett's (1987) distinction between fluency disabled and accuracy disabled readers. From Lovett's work it follows that even among English children with dyslexia, there are readers whose only problem is fluency and not accuracy. These cases may not get attention, because reading fluency most often is not taken into account in the diagnosis of English children with dyslexia (Compton & Carlisle, 1994).

The dissociation presently found between severely dysfluent reading and the absence of spelling difficulties at the symptom level corresponds to adult cases of pure alexia, a disorder resulting from brain damage. According to Farah (1999), these cases exhibit very slow but generally accurate reading of single words and texts. They also write with accuracy and ease. The visual naming speed deficit of dysfluent German children corresponds to recent theorizing based on functional neuroimaging studies by Pugh et al. (2000). These authors suggest that a specific posterior left hemispheric brain region (ventral occipito-temporal) is involved both in fast naming of visual identities and in fluent reading and is not functioning appropriately in children who are dyslexic. Reading fluency deficits have long-term stability. Klicpera and Schabmann (1993) found that the large majority of German children with a fluency deficit in the middle of Grade 2 still suffered from this deficit at the end of Grade 8.

The evidence presently found for the dissociation between poor spelling, but unimpaired reading, corresponds to English-based findings on unexpected spelling problems (Bruck & Waters, 1990; Frith, 1980; Holmes & Castles, 2001; Shankweiler, Lundquist, Dreyer, & Dickinson, 1996). The interesting finding is that these children with a single spelling deficit, in contrast to children with a single fluency deficit did have poor phonological short-term memory and poor phonological awareness in the school entrance assessment. This association between single spelling problems and phonological deficits supports the position that efficient storage of orthographic patterns depends on multiple associations between segments of the phonological word and the graphemes of the written word (Ehri, 1992; Perfetti, 1992).

The present pattern of cognitive deficits is consistent with the double-deficit theory of dyslexia of Wolf and Bowers (1999). These authors proposed that naming speed deficits measure an impairment that is independent of the well-known phonological deficits (e.g., Shankweiler, 1999; Shaywitz, 1996). In the present study, the two factors were found to be associated with different problems: The naming speed deficit was associated with the specific reading problem; the phonological deficit was associated with the specific spelling problem. We may reason further that there is a commonality between the spelling deficit of German children and the reading accuracy deficit of English children, in that both require orthographic word representations due to low grapheme–phoneme regularity. In the case of English, forward regularity is low, whereas in the case of German as in many other orthographies, backward regularity is low.

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