Word Recognition in German Primary School Children with English as a Second Language: Evidence for Positive Transfer?

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Introduction

The present study investigates word recognition abilities in the two languages of German primary school children learning English as a second language. These children were "sequentially" acquiring to read and write in German and English, i.e. they already had received two years of reading and writing instruction in their L1 before they started to learn English. The main goal of the present study is to show in how far differences in transparency of the two orthographies affect word recognition in these bilingual children and to provide evidence for transfer from a shallow L1-orthography to a deep L2-orthography.
The paper is structured as follows: in section 1 an overview on previous research done on the acquisition of reading and writing is offered. Section 2 introduces the method. In section 3 results of the present study are presented and compared to data from a study which used the same tasks and similar stimulus material. In section 4 results will be discussed according to the *dual route model of word recognition* (Coltheart 1980). Section 5 concludes this paper.

1 State of the Art/ Previous Research

In the last decade there has been an increasing body of research done on the acquisition of reading and writing. While investigations in the beginning clearly focused on the English language and orthography, there now is an extensive number of cross-orthography comparisons, especially concentrating on European languages. In their overview on this research, Sprenger-Charolles and colleagues (2006) claim that orthographic consistency is the major factor that determines the ease or difficulty of learning to read and write in different alphabetic writing systems. The term "orthographic consistency" denotes the complexity of the relation between graphemes and phonemes in an alphabetic writing system. While German orthography can be regarded as rather transparent, English orthography is characterized by its strong inconsistencies and irregularities, especially in the case of vowels. In their study of various European orthographies, among them also English and German, Seymour, Aro & Erskine (2003) came to the conclusion that, due to the differences in orthographic consistency, the rate of development in English is more than twice

as slow as in transparent orthographies, as for example German. The authors interpret these findings according to the *dual route model of word recognition* (Coltheart 1980). The model describes that there are are two different routes to grasp the meaning of a written word: a lexical or visual route and a sublexical or phonological route. Reading a word via the lexical/visual route, the written word is recognized as a whole and the corresponding entry in the mental lexicon of the reader is activated directly. Reading via the sublexical/phonological route means that the written word has to be processed phoneme-by-phoneme in advance to the activation of the corresponding entry in the mental lexicon of the reader. Results from various studies (e.g. Wimmer & Goswami 1994) suggested that children learning to read in transparent orthographies tend to move into reading via the sublexical/phonological route, since this route leads to successful decoding here, while English children rather recognize words via the lexical/ visual route in the beginning of learning to read and write, since reading via the sublexical/ phonological route would often result in mispronunciations. Accordingly, Seymour, Aro & Erskine (2003) assume that the acquisition of a transparent orthography only requires access to one of the two decoding strategies, namely the sublexical route, while acquisition of deep orthographies induces the implementation of both decoding strategies. Thus, the authors claim that the process of acquisition is more than twice as slow in English because processing- and attention-resources are divided between two functions. The findings from this study also replicate findings from older studies as for example Wimmer & Goswami (1994). In their pseudoword reading experiment, the oldest of the English-speaking children made more mistakes and also took significantly longer in reading these words than the youngest of the German children. These differences concerning phonological processing were as well interpreted as a consequence of differences in orthographic consistency.

Another topic that has recently gained increasing attention is that of reading and writing acquisition in bilingual children. Research in this field already indicated that it might be of advantage to learn to read and write in two languages. There is particular evidence for positive transfer of literacy skills in the case of transfer from rather transparent orthographies to deep orthographies, such as English (Siegel 2004). Apart from the potential for transfer of reading principles across the languages, a second advantage of bilingual literacy acquisition is that children already possess a general understanding of reading and its basis in a symbolic system of print (Bialystok and colleagues 2003). However, it has to be acknowledged as well that differences in vocabulary level may disadvantage bilingual children in early literacy compared to native speakers (Bialystok and colleagues 2003) and that bilingual children may remain slower in reading even if they achieve accuracy rates comparable to those of monolinguals (Siegel 2004).

The present study assesses basic decoding skills in the two languages of German primary school children who were learning English as a second language. The main method of the present research is to contrast reading words with reading pseudowords in both, German and English. It is a well established fact that reading of pseudowords is one of the best measures of phonological processing in an alphabetic language (Siegel 2004), since it constitutes the basis of decoding print. The reason for the utilization of this experimental technique is to find evidence for differences or similarities in word recognition between the bilingual children's German and English with respect to the dual route model. The second aim of the present study is to find evidence for positive transfer from the L1 German to the L2 English. There are two reasons which make it quite probable to assume positive transfer to occur in this cross-orthography comparison: the first is the fact that the children studied had already received two years of reading and writing instruction in their mother-tongue German before they started to learn English and the second reason is the assumption that positive transfer is likely to occur in the combination of a shallow L1-orthography with a deep L2-orthography.

2 Method

2.1 Participants

The sample consisted of 15 German primary school children in their fourth year of schooling. Experiments were conducted in the last quarter of the school year, children had an average age of 10;2 years at the time of testing. Children had received instructions in English from the beginning of third grade, thus they were learning English as L2 for almost two years at the time of testing and had already received two years of reading and writing instruction in their L1 German before they started to learn English. It has to be emphasized that instructions in English focused on establishing oral competences, however, children already had basic competences in reading and writing English. All children were reported to be free of any reading and writing disorders.

2.2 Procedure

The children completed three tasks in both, German and English. Children were tested on an individual basis in a quiet room in their school. Experimental sessions lasted about 30 minutes. Due to methodological problems, only procedure and results for two of the three tasks, namely the single word and the single pseudoword reading task, will be presented here. In each task 20 items were used, preceded by 5 practice items to familiarize the children with the task.

To ensure that children were familiar with the English words, all words presented came from the English school curriculum, although the English teacher acknowledged that children might not have encountered all of the words in their written form before. Functional equivalence of stimulus materials was controlled according to the following dimensions: word length (measured in number of syllables), syllable structure (simple CVC vs. complex consonantal clusters) and familiarity. In German, words comprised two- and three-syllable items as well as compounds. English words included one- and two-syllable items only. Words in both languages were predominantly uninflected content words. Both German and English pseudowords comprised one- and two-syllable items only and were additionally categorized as either word-similar (e.g. *blear*) or not word-similar (e.g. *tanes*). Pseudowords from both languages formed pronounceable letter strings which complied with the orthographic rules of either language. Apart from the differences concerning length measured in syllables for the German and English words (which were made to account for the differences in proficiency regarding the L2-status of English), the number of items with simple and complex syllabic structure was equal in all items in both languages. The items were presented one by one (i.e. out of context) on the screen of a notebook. After a short visual marker (fixation cross-hair) single items appeared in the center of the screen. These items were presented in upper-case letters only. The children were instructed to look at the item and press the space bar as fast as possible and then name the respective item aloud. Items disappeared from the screen as soon as the child pressed the button. A software-program (Linger) measured reaction times from the onset of the presentation until the space bar was pressed. Pseudowords in German were introduced to the children as "fantasy-words without meaning, but which can be read nevertheless". Prior to completion of the single pseudoword reading task in English, children were told that these words are fantasy-words as well and that they should try to pronounce these items the way they think they should be pronounced in English. To ensure that children understood the tasks instructions were given in German only. Additionally, experimental sessions were videotaped, which allowed for a subsequent transcription and analysis of the accuracy of the items read.

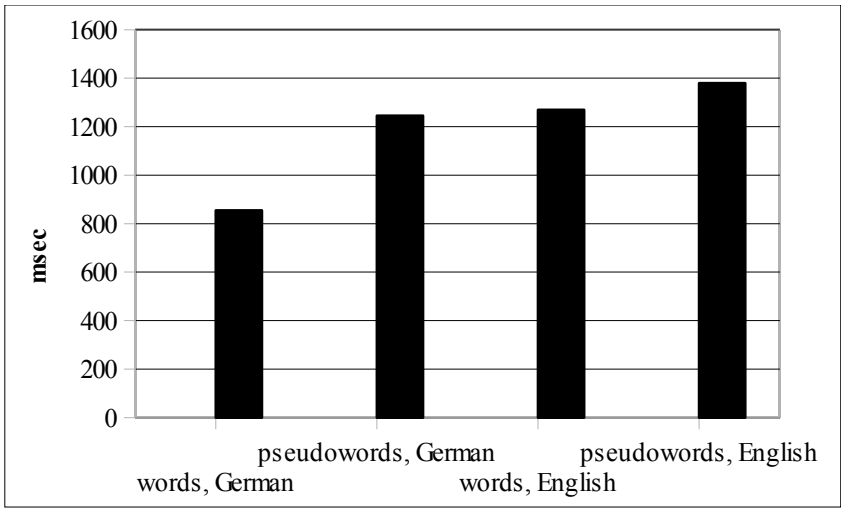
3 Results

3.1 Reaction times

Statistical analysis of reaction times for words and pseudowords in both languages yielded the following results:

1. words are read significantly faster than pseudowords in both languages (ANOVA: F (1.14) = 50.412, p<0.001; Interaction: F (1.14) = 36.222, p<0.001),
2. words are read significantly faster in German than in English (ANOVA: F (1.14) = 41.854, p< 0.001),
3. pseudowords are read significantly faster in German than in English (ANOVA: F (1.14) = 6.880, p>0.020).
Further, it is noteworthy that German words are the only category recognized below 1 second of time. It is remarkable as well that German pseudowords and English words are recognized almost equally fast.

Figure 1: Reaction times (msec)



3.2 Accuracy

3.2.1 Accuracy in single word reading, German

The table below lists types and number of the errors made by the children in the German single word reading task. First, it has to be mentioned that only two errors in all 15 children were made across the whole task. Accordingly, it can be claimed that accuracy in single word reading in these children reached almost 100%. One of the errors involved the production of a legitimate alternative word (*leider (unfortunately)* instead of *Leder (leather)*), in the second case the child added a plural suffix to the noun presented (*Pflanzen (plants)* instead of *Pflanze*

(plant)).The amount and the nature of the errors leads to the conclusion that they can be explained by an attentional deficit.

Table 1: Accuracy in single word reading, German

error types	number	%
similar word	1	50
addition of plural suffix	1	50
total errors in all 15 children	2	100

3.2.2 Accuracy in pseudoword reading, German

Table 2 displays types and number of errors in the German pseudoword reading task. Although the number of errors in this task is four times higher than in the German word reading task, the error rate remains below 3% in the pseudoword task, or, in other words, accuracy is almost 100% in this task as well. In the categories "addition of sound" (example: *Hinger* instead of *Higer*) and "confusion of sound" (example: *Scheft* instead of *Schett*) children made most errors, thus, errors predominantly include the visual confusion of letters. Altogether, types and number of errors can be explained by an attentional deficit due to excitement.

Table 2: Accuracy in pseudoword reading, German

error types	number	%
addition of sound	3	37.5
confusion of sound	2	25
pronounced as English	1	12.5
unclear	2	25
total errors in all 15 children	8	100

3.2.3 Accuracy in single word reading, English

With respect to types and number of errors in the English word reading task (table 3), it is striking that a) the error rate (15%) is at least fifteen times higher than in the corresponding German task, b) almost 2/3 of the errors made are related to pronunciation and c) almost half of the pronunciation errors involves the mispronunciation of a vowel grapheme. The most frequent mistakes made in the category of "pronunciation" besides those of vowel mispronunciation are related to mispronunciation of /th/ as either /t/ or /d/ and the pronunciation of silent sounds in words such as *talk.* These types of mispronunciations are typical of German ESL-learners, however. Astonishingly, 20% of all errors consisted of word substitutions (examples: *tell* instead of *talk*, *sheep* instead of *ship*, *bread* instead of *boat*). (Astonishingly, because only a vocabulary of considerable size allows for confusion.)

Table 3: Accuracy in single word reading, English

error types	number	%
pronunciation	34	74
word substitution	9	20
refuse	1	2
unclear	2	4
total errors in all 15 children	46	100

3.2.4 Accuracy in single pseudoword reading, English

Number and types of errors for the English single pseudoword reading task are displayed in table 4. Remarkably, the error rate (17%) is comparable to that of the English single word reading task. Similarly, error types are predominantly related to pronunciation with the majority of errors concerning the mispronunciation of vowels. However, within the category of pronunciation-errors, English pseudowords were often read out according to German pronunciation rules. As in the single word reading task, the next most frequent error type was the substitution of an English pseudoword by a real English word (example: *hook* instead of *hok*, *now* instead of *nour*, *purse* instead of *pouse*, etc.). As with the word reading task, errors in this category of the pseudoword reading task might be explained by visual similarities between the real and the novel word.

Table 4: Accuracy in single pseudoword reading, English

error types	number	%
pronunciation	41	77.3
real word substitution	6	11.3
sound omission	2	3.8
unclear	4	7.6
total errors in all 15 children	53	100

3.3 Comparison to monolingual German and English children

In this section the data from the present study will be compared to data from a study which used the same task and similar stimulus material. The aim is to work out similarities and differences between the children from the present study, who were learning to read and write in two languages, and monolingual German and English children, who had no contact to a second language in their schooling up to this point. Although Landerl and colleagues (1997) focused on the comparison of English and German dyslexic children, their reading level control group will serve as a point of reference for the data of the present study. German reading level controls (n=18) from the Landerl and colleagues study had and average age of 8;8 years (range from 7;4 - 9;5), the English reading level controls (n=21) had an average age of 8;3 (range from 7;4 - 9;1). Thus, children from the present study were about 1;6 years older than the children from the Landerl and colleagues study (but nevertheless comparable as will be shown below).

3.3.1 Comparison of reaction times, German

The table below compares reaction times for German words and pseudowords in children from the present study to those of the reading level control group (Landerl and colleagues 1997). To control functional equivalence of the stimulus materials used in the two studies, only reaction times for items with identical number of syllables are compared. Although children from the Landerl and colleagues study were about 1;6 years younger than the children from the present study, reaction times obtained by both groups in both tasks are comparable. The slight advantage for the children from the present study can be explained by the age-difference just mentioned.

Table 5: Comparison of reaction times (msec.), German

	words present study	words Landerl et al.	pseudowords present study	pseudowords Landerl et al.
1 syllable	730	750	1160	1200
2 syllables	790	950	1315	1400
3 syllables/ compounds	1100	1750	-	-
average	873	1150	1237	1300

3.3.2 Comparison of reaction times, English

Table 6 compares reaction times for English words and pseudowords in children from the present study to those of children from the Landerl and colleagues study, i. e. German primary school children with English as a second language are contrasted to monolingual English primary school children. The comparison of these two groups allows for a tentative approach to the question of whether children learning to read and write in two languages do have an advantage compared to children who learn to do so in one language only. Data in the table presented below suggest that this might indeed be the case. While reaction times for words in both groups are almost the same (with a slight advantage for the L2 -learners), a clear advantage concerning recognition of pseudowords can be observed for the ESL group. In other words: German children with English as L2 recognize English pseudowords almost twice as fast as monolingual English children.

Table 6: Comparison of reaction times (msec.), English

	words present study	words Landerl et al.	pseudowords present study	pseudowords Landerl et al.
1 syllable	1200	1250	1300	2600
2 syllables	1280	1750	1600	3000
average	1240	1500	1450	2800

3.4 Comparison of accuracy rates, German and English

Table 7 reveals that rates of accuracy are comparable in the two groups in both languages. However, a slight advantage can be observed for the children from the present study, which again might be explained by the higher age of the respective group.

Table 7: Comparison of accuracy rates, German and English

		present study	Landerl et al.
German	words	>1%	>10%
	pseudowords	>3%	>20%
English	words	15%	>25%
	pseudowords	17%	>25%

4 Discussion

The study presented investigated children's word and pseudoword reading abilities which were assessed in single item reading tasks. In the following results for reaction times and accuracy will be interpreted in the framework of the dual route model of word recognition. As expected German words were recognized fastest, followed by German pseudowords, English words and English pseudowords. Furthermore, German words were the only items which were recognized in less than one second. Ehri (2004) states that this indicates sight word reading, i.e. word recognition via the lexical route. Accordingly, there is evidence to suggest that the children under investigation recognized German words via the lexical route, while the remaining items were recognized via the sublexical route. While this result was expected for German and English pseudowords, since reading these novel words is taken to assess the efficiency of the sublexical route, the assumption that the children read English words via assembling pronunciations, i.e. the sublexical route, stands in contrast to the finding reported above for the monolingual English children. Further on, since German pseudowords and English words were recognized almost equally fast, it can be assumed that decoding (known) English words requires the same effort for German children as decoding novel German words (i.e. pseudowords). Decoding English pseudowords seems to be the most demanding task for German children, since this task requires recall and transfer of pronunciation rules from items already stored to items they had never encountered before.
The comparison of the German primary school children with English as a second language from the present study to the monolingual English children

from the Landerl and colleagues study yielded further interesting results. While both groups of children recognized English words in a comparable amount of time, there was a strong advantage for the recognition of English pseudowords for the German English-L2 children, who recognized these items almost twice as fast as the monolingual children.
Concerning accuracy, it became clear that the children from the present study reached almost 100% for recognition of words and pseudowords for the German items. Regarding the reading of pseudowords, this result confirms findings already reported from other studies, namely that phonological processing is not necessarily a demanding task (Landerl and colleagues 1997). There is a lot of evidence for the assumption that when G-P relations are consistent, children can easily acquire GPC-rules and use these to assemble pronunciations for novel strings. In the reading of English words and pseudowords German children yielded accuracy rates of about 85%, which is comparable to those of monolingual English children as well. As expected, errors predominantly concerned the mispronunciation of vowels.

5 Conclusion

Since phonological decoding leads to successful reading in German, German children are proficient in the usage of the phonological route. This advantage in phonological decoding as compared to monolingual English children leads to the observed advantage in reading pseudowords. In other words, German children "transfer" this decoding strategy to English. This transfer is fostered by the transparency of the German orthography. However, deepness of the English orthography leads to the production of decoding errors, especially in the domain of vowels, thus, no advantage concerning error rates can be observed. Hence, it can be concluded that the advantage in phonological decoding leads to faster recognition in pseudoword reading, but English orthographic complexity leads to no advantage in error rates.

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