

Available online at www.sciencedirect.com

SCIENCE @ DIRECT®

Cognition xx (2003) xxx–xxx

COGNITION

www.elsevier.com/locate/COGNIT

Brief article

Lexical orthographic knowledge develops from the beginning of literacy acquisition

Catherine Martinet^{a,*}, Sylviane Valdois^b, Michel Fayol^c^a*F.P.S.E. (Unimail), Geneva, Switzerland*^b*L.P.N.C. (CNRS), Grenoble, France*^c*LAPSCO, CNRS, Clermont-Ferrand, France*

Received 29 August 2003; accepted 1 September 2003

Abstract

This study reports two experiments assessing the spelling performance of French first graders after 3 months and after 9 months of literacy instruction. The participants were asked to spell high and low frequency irregular words (Experiment 1) and pseudowords, some of which had lexical neighbours (Experiment 2). The lexical database which children had been exposed to was strictly controlled. Both a frequency effect in word spelling accuracy and an analogy effect in pseudoword spelling were obtained after only 3 months of reading instruction. The results suggest that children establish specific orthographic knowledge from the very beginning of literacy acquisition.

© 2003 Published by Elsevier B.V.

Keywords: Spelling acquisition; Lexical knowledge; First graders; Analogy/frequency effects

1. Introduction

Classical stage theories of spelling development assume that young spellers rely mainly on phonological processing at the beginning of literacy acquisition and next progress towards an orthographic stage in which spelling is based on activation of specific lexical knowledge (Ehri, 1992, 1997; Frith, 1985; Gentry, 1982; Marsh, Friedman, Welch, & Desberg, 1980; Seymour, 1997; Seymour & Evans, 1993). The orthographic stage only establishes after acquisition of phoneme–grapheme conversion knowledge, phonological processing allowing the establishment of the orthographic lexicon. Both Frith (1985) and

* Corresponding author. Faculté de Psychologie et des Sciences de l'Éducation, Université de Genève, 40, boulevard du Pont d'Arve, CH-1205 Genève, Switzerland. Tel.: +41-22-379-90-43.

E-mail address: catherine.martinet@pse.unige.ch (C. Martinet).

Ehri (1986, 1997) suppose that considerable practice at reading by means of an alphabetic procedure allows the reader to establish internal representations of word forms. Frith (1985) claims that lexical representations must be precise enough to be transferred from reading to spelling; so, the orthographic stage develops still later in spelling. The dual foundation model of Seymour (1997) also postulates that good alphabetic knowledge is required to develop lexical orthographic representations. Indeed, Seymour hypothesizes that the logographic (visual) representations must be re-defined, via the alphabetic process, to become orthographic. All these theories thus describe development as a succession of qualitatively different stages and consider that the orthographic stage only develops in spelling after extensive literacy experience.

However, other authors (Lennox & Siegel, 1994; Mousty & Alegria, 1996; Rittle-Johnson & Siegler, 1999) consider that phonological and orthographic processing skills develop in a continuous manner from the beginning of literacy acquisition. Rittle-Johnson and Siegler (1999) have shown that even novice spellers use multiple processes, including lexical knowledge, to spell words. The self-teaching model of early reading acquisition (Share, 1995, 1999) also suggests that even very young children might have lexical representations for the words they have been repeatedly exposed to. The model posits that orthographic representations develop primarily as a function of phonological recoding and word familiarity. Within the framework of connectionist models (Ans, Carbonnel, & Valdois, 1998; Harm & Seidenberg, 1999; Plaut, McClelland, Seidenberg, & Patterson, 1996; Seidenberg & McClelland, 1989), acquisition of word knowledge is also viewed as developing as soon as children are exposed to the written forms of words together with their spoken forms. Overall, two alternative conceptualizations which postulate either a late or early development of lexical knowledge have been proposed to account for spelling development. The present study will provide new data showing that lexical spelling develops from the very beginning of literacy acquisition.

Many experimental studies have been conducted to determine when children start using lexical knowledge in spelling acquisition. Effects of regularity and lexicality were taken as estimates of reliance on phonological or orthographic processing, respectively. Sprenger-Charolles, Siegel, Béchennec, and Serniclaes (in press) found that French first graders spelled irregular words far less accurately than both regular words and pseudowords. Furthermore, regular words were never spelled more accurately than pseudowords, the latter even being spelled more accurately in the middle of Grade 1. These findings strongly suggest that novice spellers do not rely on lexical knowledge when spelling to dictation. There are two other classical signatures of use of orthographic procedure: the frequency effect in word spelling, on one hand, and the analogical effect on the other hand. However, such effects have not been reported in very beginning spellers.

Although a frequency effect was typically reported in older children, Mousty and Alegria (1996) found no frequency effect at the early stages of spelling development, suggesting that young children did not use a lexically based procedure to spell words. In contrast, Sprenger-Charolles, Siegel, and Bonnet (1998) reported that first grade children demonstrated a frequency effect when assessed after 10 months of literacy acquisition but no frequency effect was found after only 4 months. Discrepancies between these findings might first result from the absence of a strict control of word frequency. Indeed, in all these studies, frequency was estimated by reference to frequency tables established from texts

within the reach of skilled readers. Thus, these tables were not representative of the frequency of the words children were exposed to at the beginning of literacy acquisition. Second, the absence of any frequency effect cannot be straightforwardly interpreted as evidence against the use of a lexical spelling procedure when the dictated words are consistent words. Indeed, consistent words can be accurately spelled on the basis of either phonological or lexical processing, so that spelling performance might be similar on both high frequency (HF) and low frequency (LF) consistent words, independently of children's lexical knowledge. Accordingly, [Sprengr-Charolles et al. \(1998\)](#) reported that the frequency effect found at the end of first grade was stronger for irregular than for regular words.

Two experiments were carried out. In the first study, an experiment was designed in order to show evidence for a frequency effect in spelling from the beginning of literacy acquisition. For this purpose, word frequency was strictly controlled through the analysis of the participants' reading book and the dictation task was made of irregular words only. Two samples of first grade children were assessed at two different periods of the academic year: in January, after only 3 months of literacy acquisition, and 6 months later, in June. Evidence for a frequency effect after only 3 months of formal reading instruction will be interpreted as showing early development of lexical knowledge.

A second experiment was conducted in order to determine whether novice spellers spontaneously use analogies to spell novel words. Previous studies, using a lexical priming task, found a reliable analogy effect in older children but no such effect in novice spellers ([Campbell, 1985](#); [Gombert, Bryant, & Warrick, 1997](#); [Marsh et al., 1980](#); [Nation & Hulme, 1996, 1998](#)). Very early use of analogy in beginning spellers was only observed when children were provided with the basis for analogy, using a clue word technique ([Deavers & Brown, 1997](#); [Goswami, 1988](#)). These findings suggest that young children do not make use of lexical knowledge to spell novel words except when they are provided with clue words and explicitly instructed that using them might be helpful. However, most studies using priming did not establish whether the prime words were familiar to the participants. In a pseudoword spelling to dictation task, [Bosse, Valdois, and Tainturier \(in press\)](#) showed that reliable analogy effects are obtained from the second grade and can be obtained from the first grade when children are taught the spelling of the reference words – from which the target pseudowords were generated – in the months preceding the experimental task. However, very early use of analogy was not demonstrated in naturalistic situations of learning after controlling for the familiarity of the reference words. In the second study, first grade children were given a spelling to dictation task comprised only of pseudowords, some of which were phonological neighbours of HF words with unfamiliar endings. The use of these unfamiliar graphemes in pseudoword spelling was taken as evidence for spelling by analogy. For example, the pseudoword /teby/ was expected to be spelled “tébut” by analogy to the source word “début” (beginning) instead of “tébu” (the /y/ → “u” correspondence is the most frequent mapping in French). Evidence for an analogy effect in this task where no clue word or lexical prime were used as prompts will be interpreted as demonstrating that children rely on orthographic processing from the beginning of spelling acquisition.

2. Experiment 1

2.1. Method

2.1.1. Participants

The January and June samples gathered 36 (16 females and 20 males) and 73 (37 females and 36 males) first graders, respectively. Children were recruited from two different classes of a French primary school in January and from four different classes in June. The inclusion criteria were the following: (1) parental permission; (2) no language, behaviour or learning difficulties according to their teachers; (3) no repeated grade; and (4) French as mother tongue. All classes were chosen because they used the same reading method based on the same reading book.¹ This reading method emphasized a phonics approach. Each lesson focused on a new grapheme–phoneme conversion (GPC) rule and included a short text essentially constructed from words including the current rule.

2.1.2. Materials

The two lists of HF and LF irregular words were extracted from the children's reading book. For this purpose, the book was scanned, all words were indexed and their number of occurrences was calculated. The occurrence number was taken as the most objective estimation of frequency. This number varied from 1 to 490 (mean = 6.57, median = 2, total: 10371 occurrences for 1579 different words). The occurrence of most words was very low – 79.43% of the words occurred less than five times – and only 7.58% were repeated more than ten times in the reading book.² The occurrence number of each word was calculated separately for the January and June sessions according to the number of lessons which had been effectively studied in classrooms under the teachers' supervision.

A word was defined as orthographically irregular if it contained a grapheme that was not the most frequently associated in French to the corresponding phoneme. The frequency of phoneme–grapheme correspondences was controlled based on the analysis of the children's reading book. The unfamiliar target graphemes were never the graphemes most frequently associated with the corresponding phonemes in the reading book. It was further checked that none of the selected words had a phonological neighbour (Peereman & Content, 1997) including the target grapheme in the book; so, a correct spelling should only result from the activation of the experimental word lexical representation.

Two preliminary sublists of HF and LF irregular words were extracted from the children's reading book and submitted to the teachers. They were asked to check that the words which less frequently occurred in the reading book were not frequently used in other school activities. Given the small number of words with a high occurrence in the reading book, teachers further added three (HF) words that were frequently used in classrooms (i.e. “lundi” *Monday*, “trois” *three*, “phrase” *sentence*).

The experimental January list (see Appendix A) was made up of 26 irregular words: 13 HF words (mean number of occurrence = 23.38, median = 15, range: 11–62) and 13 LF

¹ The reading book was named “Ratus”, edited by Hatier (Paris, France).

² For each new lesson, words were chosen according to their ability to illustrate the currently taught GPC rule. The book thus holds a large variety of different words but offers few repetitions of each word.

Table 1

Mean number (SD) of high (HF) and low frequency (LF) words and target graphemes accurately spelled by first graders in January and June

	Words		Target graphemes	
	HF	LF	HF	LF
January ($N = 36$)	10.42/13 (2.25)	9.28/13 (2.31)	10.53/13 (1.2)	9.42/13 (2.32)
June ($N = 73$)	13.96/18 (2.90)	9.88/18 (3.69)	16.99/21 (3.01)	12.62/21 (4.04)

words (mean = 2.61, median = 3, range: 1–4). The June list (see Appendix A) contained 36 irregular words: 18 HF words (mean = 45.4, median = 24, range: 12–134) and 18 LF words (mean = 3.05, median = 3, range: 2–5). The experimental words contained one or two unfamiliar graphemes (1 on average in January; 1.17 in June). HF and LF words were matched on the number and kind of unfamiliar graphemes they contained (e.g. “trois” *three* – “bois” *wood*; “sirop” *sirup* – “loup” *wolf*). The mean number of letters, syllables and phonemes was similar in the two lists.³

2.1.3. Procedure

HF and LF words were randomized in a single list that was dictated to the children in a fixed order (see Appendix A).

2.2. Results

As shown in Table 1, HF words were spelled more accurately than LF words in both the January and June sessions. The frequency effect was significant by subjects only ($F(1, 34) = 15.20$, $MS = 1.49$, $P < 0.001$; $F(1, 24) = 2.01$, $MS = 482.85$, *NS*) in January, and by subjects ($F(1, 72) = 161.75$, $MS = 3.76$, $P < 0.001$) and by items ($F(1, 34) = 13.92$, $MS = 177.21$, $P < 0.001$) in June.

It is well admitted that beginning spellers first establish partial orthographic representations of the words they have been exposed to (Ehri, 1997; Perfetti, 1992; Tainturier, 1996) and that these representations may include irregular graphemes (Beauvois & Derouesné, 1981; Martinet & Valdois, 1999). Accordingly, a second analysis was conducted on the number of target graphemes spelled correctly whatever the accuracy of the whole sequence.

In both sessions, the irregular graphemes were more accurately spelled in HF words than in LF words (Table 1). This effect was significant by subjects only in January ($F(1, 34) = 13.22$, $MS = 1.63$, $P < 0.001$; $F(1, 24) = 2.92$, $MS = 482.52$, *NS*), and by subjects ($F(1, 72) = 149.57$, $MS = 4.66$, $P < 0.001$) and by items ($F(1, 34) = 13.92$, $MS = 177.21$, $P < 0.001$) in June.

³ Mean number of letters: in January, 59 and 58 letters by sublist; 4.5 letters by words ($F(1, 34) < 1$); in June, 90 and 94 letters by sublist; 5 and 5.2 letters by words ($F(1, 34) < 1$). Mean number of syllables: in January, 21 and 19 syllables by sublist ($F(1, 34) < 1$); in June, 30 and 31 syllables by sublist ($F(1, 34) < 1$); words were from one to four syllables long in both sessions. Mean number of phonemes: in January, 40 and 37 phonemes by sublist ($F(1, 34) < 1$); in June, 62 and 65 phonemes by sublist ($F(1, 34) < 1$).

3. Experiment 2

3.1. Method

3.1.1. Participants

The January and June samples gathered 36 (16 females and 20 males) and 31 (16 females and 15 males) first graders, respectively. Children were recruited from two different classes of a French primary school in January and in June. Teachers used the same reading book as in Experiment 1. The same criteria were also applied for the participants' selection.

3.1.2. Materials

Two sets of 60 pseudowords were designed. They included three types of pseudowords: experimental pseudowords having a lexical phonological neighbour (called neighbour PWs hereafter), control pseudowords and fillers (see Appendix B).

The *neighbour PWs* were derived from source words. All reference words ended with an unfamiliar phoneme–grapheme correspondence (e.g. /diRo/ was neighbour of /siRo/ “sirop” *sirup*). The neighbour PWs were constructed by substituting a single phoneme of the source-word initial syllable, with the constraint that the resulting pseudoword had no close neighbour other than the source word.

The *control PWs* had no lexical neighbour but they ended with the same target phonemes as the neighbour PWs. They were designed to verify that the final target phonemes were not spontaneously spelled using the unfamiliar target graphemes of interest. For example, /liko/ was designed to check that the target grapheme “op” was not spontaneously used to spell pseudowords ending with /o/ (the most frequent mapping being “eau” for /o/ in French, in this position) independently of their lexical neighbourhood.

The *fillers* had no lexical phonological neighbour and ended with none of the final target phonemes.

The two experimental lists included ten and 11 neighbour PWs, ten and 11 control PWs and, 40 and 38 fillers in January and June, respectively. A higher use of target final graphemes in neighbour pseudowords (e.g. /diRo/ written “dirop”) than in phoneme control pseudowords would provide evidence for an analogy effect.

3.1.3. Procedure

All pseudowords were mixed in a single list of 60 items. In January, the pseudowords were dictated by teachers in four sublists of 15 pseudowords. The list was dictated in two sessions in June.

3.2. Results

As shown in [Table 2](#), the participants were more prone to use the target graphemes in neighbour PWs than in control PWs.

The within-subject effect of pseudoword type was tested using the Wilcoxon test. This effect was significant in both January ($U = 117.5, P < 0.05$) and June ($U = 10, P < 0.0001$).

Table 2

Mean number (SD) of spellings using the target grapheme in neighbour and control pseudowords for the January and June sessions

	Neighbour PWs	Control PWs
January ($N = 36$)	2.94/10 (1.60)	2.33/10 (0.71)
June ($N = 31$)	2.00/11 (1.27)	0.29/11 (0.45)

The size of the effect was higher in June than in January due to a lower use of the unfamiliar target grapheme to spell control pseudowords in June.

4. Discussion

In the two experiments reported in this study, both a frequency effect in word spelling accuracy and an analogy effect in pseudoword spelling were found to characterize the performance of novice spellers after only 3 months of formal reading instruction. It is the first time that such effects have been reported in children so young. For the first time also, the present experiments were based on a strict control of the words the participants were exposed to and on an estimation of word frequency through the analysis of the children's reading book. The inability of previous studies to demonstrate the precocity of lexical effects in spelling was probably due to the fact that the participants' lexical knowledge was not strictly controlled. The present findings suggest that children establish orthographic traces of the words they are exposed to very early on and use this knowledge to generate new word spellings as soon as it is available.

Results of Experiment 2 further show that children use target unfamiliar graphemes in control pseudowords far less often in June than in January. This finding suggests that the concurrent sound-to-letter mappings extracted from the words children were exposed to do not strongly differ in frequency after only 3 months of literacy acquisition. Accordingly, different concurrent mappings can be used to spell all kinds of pseudowords and unfamiliar graphemes occur in control pseudowords as well. However, the different mappings become more contrasted in frequency as exposure to printed words increases; the most frequent sound-to-letter correspondences are then preferentially used so that unfamiliar graphemes less often occur in control pseudoword spellings after 9 months of literacy instruction. This finding suggests that lexical knowledge and general knowledge about sound-to-spelling correspondences are simultaneously acquired.

Overall, the present results suggest that it is not appropriate to view spelling acquisition as a stage-like sequence where lexical knowledge establishes only in later stages of literacy acquisition once alphabetic skills are sufficiently well established. In the two experiments reported here, the participants demonstrated the ability to use lexical knowledge in spelling after only 3 months of formal reading instruction. Their non-lexical knowledge was not well established at this time and continued to evolve with increasing exposure to the written language. Such results are consistent with models of spelling development where lexical knowledge and alphabetic skills mutually influence and develop simultaneously from the very beginning of literacy acquisition.

Acknowledgements

Requests for reprints should be addressed to Sylviane Valdois, Laboratoire de Psychologie et Neurocognition (UMR5105 CNRS), Université Pierre Mendès France, BP47, 38040 Grenoble Cedex, France. This research was supported by the CNRS (Centre National de la Recherche Scientifique) and by grants from the “Région Rhône-Alpes” (A.R.A.S.S.H. program L099552401 and L099552402) to C. Martinet during her doctoral dissertation.

Appendix A. Lists of the words used in Experiment 1

A.1. January session

Words	Frequency	Grammatical category
Tête <i>Head</i>	HF	Noun
Sous <i>Under</i>	LF	Grammatical
Comme <i>Like</i>	HF	Grammatical
Rat <i>Rat</i>	HF	Noun
Sortie <i>Out</i>	LF	Noun
Épée <i>Sword</i>	LF	Noun
Dans <i>In</i>	HF	Grammatical
Voiture <i>Car</i>	HF	Noun
Rêve <i>Dream</i>	LF	Noun
Joie <i>Joy</i>	LF	Noun
Sirop <i>Syrup</i>	HF	Noun
Pas <i>Not</i>	HF	Grammatical
Mot <i>Word</i>	HF	Noun
Rond <i>Round</i>	LF	Noun
Toit <i>Roof</i>	LF	Noun
Loup <i>Wolf</i>	LF	Noun
Chocolat <i>Chocolate</i>	LF	Noun
Fort <i>Strong</i>	LF	Grammatical
Panne <i>Failure</i>	LF	Noun
Gros <i>Large</i>	HF	Grammatical
Mais <i>But</i>	HF	Grammatical
Faux <i>False</i>	HF	Grammatical
Vert <i>Green</i>	HF	Grammatical
Roue <i>Wheel</i>	LF	Noun
Pont <i>Bridge</i>	LF	Noun
Confiture <i>Jam</i>	HF	Noun

A.2. June session

Words	Frequency	Grammatical category
Maison <i>House</i>	HF	Noun
Heure <i>Hour</i>	LF	Noun
Trois <i>Three</i>	HF	Noun
Balai <i>Broom</i>	LF	Noun
Rat <i>Rat</i>	HF	Noun
Jus <i>Juice</i>	LF	Noun
Mot <i>Word</i>	HF	Noun
Loup <i>Wolf</i>	LF	Noun
Faux <i>False</i>	HF	Grammatical
Semaine <i>Week</i>	LF	Noun
Vert <i>Green</i>	HF	Grammatical
Bras <i>Arm</i>	LF	Noun
Lundi <i>Monday</i>	HF	Noun
Chaud <i>Hot</i>	LF	Grammatical
Vrai <i>True</i>	HF	Grammatical
Pied <i>Foot</i>	LF	Noun
Histoire <i>Story</i>	HF	Noun
Phare <i>Lighthouse</i>	LF	Noun
Gros <i>Large</i>	HF	Grammatical
Bois <i>Wood</i>	LF	Noun
Alors <i>Then</i>	HF	Grammatical
Téléphone <i>Phone</i>	LF	Noun
Taureau <i>Bull</i>	HF	Noun
Demain <i>Tomorrow</i>	LF	Grammatical
Petit <i>Small</i>	HF	Grammatical
Toit <i>Roof</i>	LF	Noun
Sirop <i>Syrup</i>	HF	Noun
Banc <i>Bench</i>	LF	Noun
Phrase <i>Sentence</i>	HF	Noun
Autrefois <i>Formerly</i>	LF	Grammatical
Dans <i>In</i>	HF	Grammatical
Brebis <i>Ewe</i>	LF	Noun
Pas <i>Not</i>	HF	Grammatical
Départ <i>Departure</i>	LF	Noun
Eléphant <i>Elephant</i>	HF	Noun
Bord <i>Edge</i>	LF	Noun

Appendix B. List of the target pseudowords used in Experiment 2*B.1. January session*

Phonology of neighbour PW and possible analogical spelling (reference words in parentheses)	Phonology of control PW and possible orthographic correspondence	Phoneme–grapheme conversion tested
/puʃ [^] ʀi/-“poucherie” (boucherie- <i>butcher’s shop</i>)	/nɛbi/-nèbi	/_i/ → “_ie”
/dirO/-“dirop” (sirop- <i>syrup</i>)	/likO/-lico	/_o/ → “_op”
/sOkOla/-“socolat” (chocolat- <i>chocolate</i>)	/nyla/-nula	/_a/ → “_at”
/tõfityR/-“tonfiture” (confiture- <i>jam</i>)	/rityR/-ritur	/_yr/ → “_ure”
/vyme/-“vumée” (fumée- <i>smoke</i>)	/nOfe/-nofé	/_e/ → “_ée”
/S [^] kuR/-“checours” (secours- <i>help</i>)	/kiduR/-quidour	/_uR/ → “_ours”
/yrmwar/-“urmoire” (armoire- <i>wardrobe</i>)	/didwar/-didoir	/_war/ → “_oire”
/apinar/-“apinard” (épinard- <i>spinach</i>)	/kovar/-covar	/_ar/ → “_ard”
/teby/-“tébut” (début- <i>beginning</i>)	/bidy/-bidu	/_y/ → “_u”
/kõdol/-“condole” (gondole- <i>gondola</i>)	/dapol/-dapol	/_ol/ → “_ole”

B.2. June session

Phonology of neighbour PW and possible analogical spelling (reference words in parentheses)	Phonology of control PW and possible orthographic correspondence	Phoneme–grapheme conversion tested
/askarGo/-“ascargot” (escargot- <i>snail</i>)	/likO/-lico	/_O/ → “_ot”
/ganaR/-“ganard” (canard- <i>duck</i>)	/linar/-linar	/_aR/ → “_ard”
/ipɛ/-“iprès” (après- <i>after</i>)	/lydɛ/-ludet	/_ɛ/ → “_ès”
/sOkOla/-“socolat” (chocolat- <i>chocolate</i>)	/nyla/-nula	/_a/ → “_at”
/Olor/-“olors” (alors- <i>then</i>)	/nivor/-nivor	/_or/ → “_ors”
/Êfã/-“infant” (enfant- <i>child</i>)	/lOmã/-loman	/_ã/ → “_ant”
/puS [^] ʀi/-“poucherie” (boucherie- <i>butcher’s shop</i>)	/nɛbi/-nèbi	/_i/ → “_ie”
/t [^] mÊ/-“temain” (demain- <i>tomorrow</i>)	/fadÊ/-fadin	/_Ê_/ → “_ain”
/tõfityR/-“tonfiture” (confiture- <i>jam</i>)	/rityR/-ritur	/_yr/ → “_ure”
/S [^] kuR/-“checours” (secours- <i>help</i>)	/kiduR/-quidour	/_uR/ → “_ours”
/teby/-“tébut” (début- <i>beginning</i>)	/bidy/-bidu	/_y/ → “_u”

References

- Ans, B., Carbonnel, S., & Valdois, S. (1998). A connectionist multiple-trace memory model for polysyllabic word reading. *Psychological Review*, *105*, 678–723.
- Beauvois, M. F., & Derouesné, J. (1981). Lexical or orthographic agraphia. *Brain*, *104*, 21–49.
- Bosse, M. L., Valdois, S., & Tainturier, M. J. (in press). Analogy without priming in early spelling development. *Reading and Writing*
- Campbell, R. (1985). When children write nonwords to dictation. *Journal of Experimental Child Psychology*, *57*, 133–151.
- Deavers, R. P., & Brown, G. D. A. (1997). Rules versus analogies in children's spelling: evidence for task dependence. *Reading and Writing*, *9*, 339–361.
- Ehri, L. C. (1986). Sources of difficulty in learning to spell and read. *Advances in Developmental and Behavioural Pediatrics*, *7*, 121–195.
- Ehri, L. C. (1992). Review and commentary: stages of spelling development. In S. Templeton, & D. R. Bear (Eds.), *Development of orthographic knowledge and the foundations of literacy: a memorial festschrift for Edmund H. Henderson* (pp. 307–332). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Ehri, L. C. (1997). Learning to read and learning to spell are one and the same, almost. In C. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: research, theory and practice across languages* (pp. 237–269). Mahwah, NJ: Lawrence Erlbaum Associates.
- Frith, U. (1985). Beneath the surface of developmental dyslexia. In K. Patterson, J. Marshall, & M. Coltheart (Eds.), *Surface dyslexia* (pp. 301–330). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Gentry, J. R. (1982). An analysis of developmental spelling in GNY5 AT WRK. *The Reading Teacher*, *36*, 192–200.
- Gombert, J.-E., Bryant, P., & Warrick, N. (1997). Children's use of analogy in learning to read and spell. In C. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: research, theory and practice across languages* (pp. 221–235). Mahwah, NJ: Lawrence Erlbaum Associates.
- Goswami, U. (1988). Orthographic analogies and reading development. *The Quarterly Journal of Experimental Psychology*, *40A*(2), 239–268.
- Harm, M. W., & Seidenberg, M. S. (1999). Phonology, reading acquisition and dyslexia: insights from connectionist models. *Psychological Review*, *106*, 491–528.
- Lennox, C., & Siegel, L. S. (1994). The role of phonological and orthographic processes in learning to spell. In G. D. A. Brown, & N. C. Ellis (Eds.), *Handbook of spelling: theory, process and intervention* (pp. 92–109). Chichester: Wiley.
- Marsh, G., Friedman, M., Welch, V., & Desberg, P. (1980). The development of strategies in spelling. In U. Frith (Ed.), *Cognitive processes in spelling* (pp. 339–354). London: Academic Press.
- Martinot, C., & Valdois, S. (1999). L'apprentissage de l'orthographe d'usage et ses troubles dans la dyslexie développementale de surface. *L'Année Psychologique*, *99*(4), 577–622.
- Mousty, P., & Alegria, J. (1996). L'acquisition de l'orthographe et ses troubles. In S. Carbonnel, P. Gillet, M.-D. Martory, & S. Valdois (Eds.), *Approche cognitive des troubles de la lecture et de l'écriture chez l'enfant et l'adulte*. Marseille: SOLAL Collection Neuropsychologie.
- Nation, K., & Hulme, C. (1996). The automatic activation of sound-letter knowledge: an alternative interpretation of analogy and priming effects in early spelling development. *Journal of Experimental Child Psychology*, *63*, 416–435.
- Nation, K., & Hulme, C. (1998). The role of analogy in early spelling development. In C. Hulme, & R. M. Joshi (Eds.), *Reading and spelling: development and disorders* (pp. 433–445). Mahwah, NJ: Lawrence Erlbaum Associates.
- Peereman, R., & Content, A. (1997). Orthographic and phonological neighborhoods in naming: not all neighbors are equally influential in orthographic space. *Journal of Memory and Language*, *37*(3), 382–410.
- Perfetti, C. A. (1992). The representation problem in reading acquisition. In P. Gough, L. C. Ehri, & R. Treiman (Eds.), *Reading acquisition* (pp. 145–174). Hillsdale, NJ: Erlbaum.
- Plaut, D. C., McClelland, J. L., Seidenberg, M., & Patterson, K. E. (1996). Understanding normal and impaired word reading: computational principles in quasi-regular domains. *Psychological Review*, *103*, 56–115.

- Rittle-Johnson, B., & Siegler, R. S. (1999). Learning to spell: variability, choice and change in children's strategy use. *Child Development*, 70, 332–348.
- Seidenberg, M., & McClelland, J. L. (1989). A distributed developmental model of word recognition and naming. *Psychological Review*, 96, 523–568.
- Seymour, P. H. K. (1997). Foundation of orthographic development. In C. Perfetti, L. Rieben, & M. Fayol (Eds.), *Learning to spell: research, theory and practice across languages* (pp. 319–337). Mahwah, NJ: Lawrence Erlbaum Associates.
- Seymour, P. H. K., & Evans, H. M. (1993). The visual (orthographic) processor and developmental dyslexia. In D. Willows, R. Kruk, & E. Corcos (Eds.), *Visual processes in reading and reading disabilities* (pp. 347–376). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Share, D. L. (1995). Phonological recoding and self-teaching: *sine qua non* of reading acquisition. *Cognition*, 55, 151–218.
- Share, D. L. (1999). Phonological recoding and orthographic learning: a direct test of the self-teaching hypothesis. *Journal of Experimental Child Psychology*, 72, 95–129.
- Sprenger-Charolles, L., Siegel, L. S., Béchennec, D., & Serniclaes, W. (in press). Development of phonological and orthographic processing in reading aloud, in silent reading and in spelling: a four-year longitudinal study. *Journal of Experimental Child Psychology*
- Sprenger-Charolles, L., Siegel, L. S., & Bonnet, P. (1998). Reading and spelling acquisition in French: the role of phonological mediation and orthographic factors. *Journal of Experimental Child Psychology*, 68(2), 134–165.
- Tainturier, M. J. (1996). Les dysgraphies centrales: état de la recherche et nouvelles perspectives. In S. Carbonnel, P. Gillet, M. D. Martory, & S. Valdois (Eds.), *Approche cognitive des troubles de la lecture et de l'écriture chez l'enfant et l'adulte* (pp. 252–274). Marseille: SOLAL.