

# The development of spelling production and orthographic awareness in young Greek spellers

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## 1 Introduction

Spelling is decisive in the development of writing which is one of the most basic academic skills. Those who experience spelling problems cannot devote their attention to higher writing processes (Bereiter 1980), while good spellers are capable of expressing themselves in writing better than poor spellers (Templeton 1991). Thus, the mastery and correct use of a language's spelling system is a major challenge in the process of language development.

The main goal of this study is to investigate the development of two core components of spelling ability of Greek children: spelling production and orthographic awareness.

In order to acquire expertise in reading and spelling in an alphabetic language, children must typically learn correspondences between individual phonemes and appropriate graphemes. However, this does not suffice for competent spelling, as in many languages, spelling is also based on morphemes and on orthographic patterns of pronunciations that cannot be predicted by phoneme-grapheme conversion. Despite cases where a phoneme corresponds to a single grapheme, there exist more complex grapheme-phoneme relations where a single phoneme can be represented through several graphemes or several phonemes can be expressed through a single grapheme (Treiman 1993). For instance, /i/ could be represented graphemically as 'ea' in *meat*, as 'ee' in *seek*, as 'ei' in *conceive* or as 'ey' in *key*. On the other hand, /ð/ and /θ/ are represented by the same grapheme, 'th' in *the* and *theater*. These inconsistencies in sound-spelling correspondence create a sense of irregularity and ambiguity, which children attempt to resolve by using strategies based on familiar spelling patterns (Laxon, Coltheart and Keating 1988) or on their developing appreciation of morphemic structures (Varnhagen, McCallum and Burstow 1997).

Although, the obvious importance of morphological strategies for spelling achievement in alphabetic orthographies is widely recognized (Sterling 1983, Morris and Perney 1984, Waters, Bruck and Malus-Abramowitz 1988, Bruck and Waters 1990), findings about the onset of the use of this type of strategies are contradictory (Treiman 1993, Treiman, Cassar and Zukowski 1994, Waters *et al.* 1988, Bryant and Nunes 1998, Nunes, Bryant and Bidman 1997, Fayol, Thevenin, Jarousse and Totereau 1999).

Some studies have shown that children use phonological as well as morphological strategies early in their spelling development (i.e. Treiman, Cassar

and Zukowski 1994). However, this early acquisition age has not been replicated by other studies (Waters *et al.* 1988, Bryant and Nunes 1998, Fayol, Thevenin, Jarrousse and Totereau 1999). Nunes, Bryant and Bindman (1997), in a longitudinal study, showed that children initially spelled past regular verbs phonetically (e.g. *stept* for *stepped*) then used the written form, *-ed*, even for grammatically inappropriate words (e.g. *sofed* for *soft*), then used *-ed* for all verbs (e.g. *keped* for *kept*) and, finally, used *-ed* only for regular verbs (see Totereau, Barrouillet and Fayol 1997, for a similar sequence concerning the acquisition of the nominal and verbal plurals in written French).

Production and awareness of spelling are two core components of spelling ability. They allow people to write and proofread text. Although intricately linked, the two components are not identical. Although spelling production is largely studied, both in children and in adults, there is lack of data concerning orthographic awareness tasks (Cassar and Treiman 1997, Siegel, Share and Geva 1995) of children and particularly of adults.

Thus, there is no doubt that systematic study on their relationship is required in order to shed light on their similarities as well as their differences (Perry, Ziegler and Coltheart 2002).

Cassar and Treiman (1997) noted that children's awareness of doubling constraints in medial and final letter positions differed from error patterns found in spelling production. In their orthographic choice experiment, the children exhibited a similar level of accuracy when judging whether a letter could be doubled in a medial or a final position. Conversely, in a number of previous spelling studies (Stage and Wagner 1992, Treiman, Berch and Weatherston 1993) children tended to have more difficulty spelling medial than final letters. Such a pattern suggests the existence of a difference between the levels of children's orthographic awareness and spelling production.

The present study aims at investigating the type of strategies Greek elementary-school aged children (one group of third graders and one group of fourth graders) use in order to make their spelling decisions.

Greek language is characterized as a semi-transparent language as, in some cases, there is a 1:2 or to many correspondence between phonemes and graphemes i.e. the /e/ /o/ and /i/. When the phoneme /i/ corresponds to an inflectional morpheme its spelling is rule-based. Therefore the phoneme /i/ should be transcribed as *οι* for the masculine plural nouns but as *ει* for the active verb in the third singular person.

In order to spell correctly inflectional morphemes, children have to be aware of these morphological constraints and use the appropriate morphological strategies. Findings for spelling development in Greek show that as early as first grade, children are able to use morphological strategies. As age progresses, the use of morphological strategies becomes more and more efficient resulting in much fewer errors in sixth graders (Αϊδίνης 2000, Chliounaki and Bryant 2002, Αϊδίνης and Παράσχου 2004, Διακογιώργη, Μπαρής and Βαλμάς 2005, Διακογιώργη, Τασσιοπούλου and Κουρκούτα 2008).

The study was carried out through 4 phases. During these phases, five experiments were conducted. Data collection took place in the second semester of the school-year and its duration was 3 months.

During phase 1, two experiments were carried out with the use of two types of orthographic tasks: a spelling production task and an orthographic choice task. During phase 2, children of both ages were asked to proof-read their orthographic productions (experiment 3). During Phase 3, half of the participants were asked to justify their spellings (either right or wrong) of the experiment 1, to judge their proof-reading of the experiment 3 (experiment 4). During phase 4, the participants of phase 2 were asked to carry out a new spelling task containing the spelling targets of the experiment 1 (experiment 5).

Given the limits of the present paper, some results of the experiment 1 and the experiment 2 will be presented.

## 2 Method

### 2.1 Participants

A total of two hundred and six Greek elementary school – age children participated in the experiments: one hundred and three third graders (aged from 8.1 to 8.11 years, with mean of age: 8 years and 6 months) and one hundred and two fourth graders (aged from 9 years to 10 years, mean of age: 9 years and 5 months). The children attended elementary schools in Patras. None of the children was dyslexic, nor suffered cognitive impairments or severe learning difficulties.

### 2.2 Materials

The orthographic behavior of the subjects was examined (a) on the processing of the homophonous words πολύ /poli/, πολλή /poli/ and πολλοί /poli/, (b) on the neuter nouns with the ending *-v* e.g., βράδυ (*evening*), δάκρυ (*tear*) which are considered as an orthographic exception to the regular spelling of the neuter nouns in Greek namely with the ending *-ι*, noun- adjective agreement e.g., απλή και εύκολη άσκηση (*simple and easy exercise*) and, (c) on the homophonous verbal ending /-ete/ which belongs both to the active voice verbs e.g., παίζετε (*you play*) and to the passive voice verbs e.g., παίζεται (*it is played*). Forty sentences containing the targets were constructed for both tasks, 18 sentences (for the third graders) and 22 sentences (for the fourth graders).

*Examples of sentences for the spelling production task:*

- (1) Στο γραφείο μου υπάρχουν πολλοί φάκελοι  
In the office my are many files  
In my office there are many files.'

- (2) Το χθεσινό βράδυ δεν ήταν ζεστό.  
The last evening not was hot  
'Last evening was not hot.'
- (3) Είδαν μια πολύ αστεία ταινία.  
Saw one very funny movie  
'They saw a very funny movie.'
- (4) Πέρασαμε τα βράδια μας στην εξοχή  
Passed the evenings our in the country  
'We passed our evenings in the country.'

*Examples of sentences for the orthographic choice task*

- (5) Πήραν μια ..... μεγάλη τηλεόραση (πολύ, πολλή, πολλοί)  
bought a ..... big television (very, very, very)  
'They bought a ..... big television (very)'
- (6) Το χθεσινό ..... ήταν ευχάριστο (βράδι, βράδυ, βράδοι)  
the last ..... was pleasant (evening, evening, evening)  
'Last ..... was pleasant (evening).'
- (7) Στόλισα την είσοδο με ..... και λουλούδια (στάχια, στάχεια, στάχια)  
Decorated the entry with ..... and flowers (wheatears wheatears wheatears)  
'I decorated the entry with ..... and flowers (wheatears).'

## 2.3 Procedure

### Experiment 1

Participants were asked to listen to a number of sentences each of which included an orthographic target-word. After listening to each sentence, the participants had to spell the whole sentence on their answer sheets.

### Experiment 2

Participants were presented with sentences, similar to those used in experiment 1, and were asked to choose the correct spelling of the orthographic target-words, which were the same as those used in the experiment 1, among twofold or threefold multiple choices.

There was a 15 days interval between the two experiments.

## 3 Results

Results obtained by the analyses of two types of targets will be presented: the targets *πολύ* /poli/, *πολλή* /poli/ and *πολλοί* /poli/, and the neuter nouns with the ending *-v*.

The mean percentages of correct spelling production for /poli/ for the third graders appear in Table 1. As can be observed, children's performances are much better for *πολύ* than for *πολλοί* and *πολλή* (*πολύ* (89% for both observations) > *πολλοί* (37% and 43%) > *πολλή* (16% and 27%). The result of comparison performed on the three targets was significant ( $x^2 = 93,496$ ,  $p = .000$ ,  $df = 2$ ).

The mean percentages of correct spelling production for /poli/ for the fourth graders are presented in Table 1. As has been also observed for the third graders, *πολύ* gathered the higher percentages of correct spellings: *πολύ* (80 % and 71 %) > *πολλοί* (61%) > *πολλή* (42% and 43%). Statistical analysis showed that the result of their comparison is significant ( $x^2 = 22,989$ ,  $p = .000$ ,  $df = 2$ ).

	Πολύ	Πολύ	Πολλή	Πολλή	Πολλοί	Πολλοί
<b>Third graders</b>	89	89	16	27	37	43
<b>Forth graders</b>	80	71	42	43	61	61

Table 1. Mean percentages of correct spellings for /poli/, for the third and forth graders.

Error analysis showed that, when children do not know the correct spelling for *πολλή* and *πολλοί*, they prefer to spell them as *πολύ*: for third graders *πολλή* (88%) and *πολλοί* (61% and 66%) and for the fourth graders *πολλή* (85% and 80%) and *πολλοί* (25% and 39%). Thus, it appears that wrong spelling productions are not random. Children's productions involve the most common statistically sound-

spelling relationship. Furthermore, the relatively low percentages of spelling *πολλοί* as *πολύ* suggest that children have a certain awareness of the singular – plural opposition which may limit them in a way that they avoid to spell a plural form (*πολλοί*) as a singular (*πολύ*).

As can be observed in table 2, percentages of correct choices for the third graders are as follow: *πολλοί* (81% and 76%) > *πολύ* (79% and 65%) > *πολλή* (29% and 41%). Comparison's result is significant ( $x^2 = 66,112$ ,  $p = .000$ ,  $df = 2$ ). Fourth graders' performances follow exactly the same pattern: *πολλοί* (94% και 95%) > *πολύ* (60% και 52%) > *πολλή* (53% και 56%) (table 2). Error analysis indicated results similar to the results obtained in the spelling production task: Children choose *πολύ* instead of *πολλή* (99% and 98%) or *πολλοί* (90% and 84%) but they do not choose *πολλή* instead of *πολλοί* and vice versa. Similarly, if children fail to choose *πολύ*, they tend to choose *πολλή* over *πολλοί* and to a much lesser degree *πολλοί* (*πολλή* 82% and 81% vs. 18% and 19% for *πολλοί*). This result suggests that children have a certain awareness of the singular-plural opposition which does not allow them to choose a singular form in the place of a plural.

	Πολύ	Πολύ	Πολλή	Πολλή	Πολλοί	Πολλοί
<b>Third graders</b>	79	65	29	41	81	76
<b>Forth graders</b>	60	52	53	56	94	95

**Table 2. Mean percentages of correct choices for /poli/, for the third and forth graders.**

The result of children's performances comparison for spelling production task and orthographic choice task is significant for all targets examined: *πολύ* ( $Z = -3,488$ ,  $p = .000$ ), *πολλή* ( $Z = -3,627$ ,  $p = .000$ ) and *πολλοί* ( $Z = -6,282$ ,  $p = .000$ ) (see figure 1).

Nevertheless, comparison's analysis showed that all obtained differences were not in the same direction. In particular, *πολύ* has been shown to have a significant advantage in spelling production task whereas *πολλή* and *πολλοί* had a significant advantage in the orthographic choice task. The first finding is that orthographic choice task favors the processing of difficult spelling cases. A similar pattern of results has been obtained for the fourth graders: *πολύ* ( $Z = -3,682$ ,  $p = .000$ , for *πολλή* ( $Z = -2,688$ ,  $p = .007$ ) and for *πολλοί* ( $Z = -5,846$ ,  $p = .000$ ). In the orthographic choice task, the stimulus is not favored.

With respect to the processing of the neuter nouns in -v, the mean percentages of correct spelling production, for both groups, appear in table 3. For the third graders, a strong advantage for *βράδυ* and *βράδια* was obtained compared to *δίχτυ* and *δίχτυα* (87% and 93% vs. 58% and 28%, respectively). Similar, for the fourth graders, a strong advantage for *δάκρυ* and a slightly less strong advantage for

*δάκρυα* were obtained compared to *στάχυ* and *στάχυα* (89%, 73% vs. 45% and 19%, respectively).

	<b>Βράδυ</b>	<b>Δίχτυ</b>	<b>Βράδια</b>	<b>Δίχτυα</b>
<b>Third graders</b>	87	58	93	28
	<b>Στάχυ</b>	<b>Δάκρυ</b>	<b>Στάχυα</b>	<b>Δάκρυα</b>
<b>Forth graders</b>	45	89	19	73

**Table 3. Mean percentages of correct spellings for neuter nouns in -v, for the third and forth graders.**

The mean percentages of correct orthographic choices are presented in Table 4. For the third graders, high percentages for ‘βράδυ’ (89%), were obtained but lower for *βράδια* (72%), *δίχτυ* (77%), *δίχτυα* (56%). For the fourth graders, high percentages for *δάκρυ* were obtained (84%) but lower for *δάκρυα* (76%), while the same applied for *στάχυ* (62%) and *στάχυα* (33%).

	<b>Βράδυ</b>	<b>Δίχτυ</b>	<b>Βράδια</b>	<b>Δίχτυα</b>
<b>Third graders</b>	89	77	72	56
	<b>Στάχυ</b>	<b>Δάκρυ</b>	<b>Στάχυα</b>	<b>Δάκρυα</b>
<b>Forth graders</b>	62	84	33	76

**Table 4. Mean percentages of correct choices for the neuter nouns in -v, for the third and forth graders.**

The result of comparison of children’s performances on the two tasks is significant: for the three graders ( $\chi^2 = -3,451$ ,  $p = .001$ ) and for the fourth graders ( $\chi^2 = -2,201$ ,  $p = .028$ ).

Overall, these results, from both tasks show great differences between the specific neuter nouns in -v. This suggests that these nouns, although they are treated by grammar as belonging to the same spelling category, are processed in a different manner.

The most obvious explanation for this discrepancy is the different frequency of these nouns in the linguistic input. The nouns *βράδυ*, *βράδια*, *δάκρυ* *δάκρυα* are much more frequent than the other nouns examined. According to the “ILSP PsychoLinguistic Resource” (IPLR), a new online psycholinguistic resource for Greek language based on analyses of written corpora combined with text processing technologies and developed at the Institute for Language and Speech Processing (ILSP) (see Protopapas, Tzakosta, Chalmandaris and Tsiakoulis, 2010) the relative frequencies of the examined words are the following: in a total of 47.013.924 words contained in the data base, 9414 occurrences are identified

for *βράδυ*, 274 for *βράδια*, 107 for *δάκρυ*, 534 for *δάκρυα*, 102 for *δίχτυ*, 706 for *δίχτυα*, 14 for *στάχυ* and 21 for *στάχυα*<sup>1</sup>.

#### 4 Discussion

The main objective of the present study was to examine two interrelated dimensions of spelling development, orthographic awareness and sound-spelling relationships' production. The question posed is whether there is similarity or, conversely, dissociation between these two core spelling components.

The idea here was that if findings supporting the dissociation were to be found, then different spelling processes might be claimed. If children used correctly certain sound-spelling relationships but failed to judge their legality, this would suggest that there are certain difficulties associated with the sound – spelling awareness that are not associated with the spelling production and vice versa.

In the present study, the results of two experiments examining children's spelling production and spelling awareness were presented. The participants were presented with two different spelling tasks: a spelling production task and an orthographic choice task. The results provided evidence that the two spelling components may differ critically.

Children's scores/performance were better in the orthographic choice task than in the production task, for both age groups. This could be accounted for by the lower cognitive cost of the recognition process, involved in the choice task as compared to the recall process involved in the spelling production task. Nevertheless, children's spelling behavior is not totally task-dependent.

Indeed, an interesting pattern of results was obtained: when the orthographic target was a 'difficult' word, children's spelling behavior was facilitated when this word had to be recognized among others rather than when it had to be produced. 'Difficult' words, in the present research, appeared to be words that carry a low frequency morpheme like *υ* (e.g. the neuter nouns in *-υ*) or a morpheme containing a bigram as *οι* (for *πολλοί*) which, in addition, are low frequent words as is the case for the majority of the neuter nouns in *-υ*. On the contrary, high frequent targets, regardless of whether they carry low frequent endings were better processed in the production task than in the orthographic choice task (e.g. *πολύ*).

One possible explanation of this pattern could be that, in some cases, the frequency rate of a word can be so elevated that it may constitute an obstacle in the choice procedure. For example, when spelling */poli/*, even if children do not apply the appropriate morphological strategy, they produce the correct spelling by simply using the statistically most common spelling; that is *πολύ*. Conversely, in

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<sup>1</sup> Invoking these frequencies calls for great caution given that they are not based on analyses from children's linguistic input. However, such data do not exist for Greek language. Thus, the IPLR aforementioned frequencies will be considered as purely indicative.

the choice task, when the correct choice is 'πολύ', children doubt about their tendency to choose the most common spelling of the word. Thus, in order to avoid the easy but risky choice, they choose one of the alternatives. The same pattern of strategies is observed on the processing of *βράδυ* and *βράδια*.

This could probably explain why children's performance, of both age groups, on the three aforementioned targets is significantly lower in the choice task than in the production task.

In light of the results of the present study, one could claim that what determines children's performances is not the degree of task's difficulty. Rather, it seems that children's spelling behavior is regulated by a kind of interaction between the nature of the task and the nature of the orthographic target. The nature of the orthographic target is determined by two internal characteristics: its morphological construction and its frequency. However, the extent to which these two characteristics affect children's spelling behavior differ. Children may be sensitive to morphological constraints and become more and more capable of employing morphological strategies but, at least till the age examined in this experiment, they appear to differentiate these strategies according to the relative frequency of the items involved.

Therefore, what reveals to be the most important factor in spelling is the frequency of the word to be spelled. In the present study, children made spelling decisions largely on the basis of frequency-based associations rather than on the basis of the morphological distinction between the three genders of the adjective /poli/ even though the context provided them with clear cues for making this morphological distinction. Our findings are in line with the findings presented by Deacon and Bryant (2005), who show that 5 to 9-year-old children and adults do not usually base their spellings of plural real-word and pseudo-word endings on the morphological rule that all regular plurals are spelled with *-s*. Instead, participants appeared to use their knowledge of complex but untaught spelling patterns, which is based on the frequency with which certain letters cooccur in written English.

These conclusions need to be confirmed through the use of different presentation formats for the experimental words. Crosslinguistic research and analyses are also needed in this direction. Nevertheless, the results obtained in the present study have developmental significance for two reasons. First, they suggest that apart from data derived from spelling production tasks, data from orthographic awareness tasks have also to be used so that the processes underlying spelling and orthographic development are better understood. Second, they reveal that despite of the existence of a morphology-based rules or exceptions to the rules that are relatively simple, reliable and discussed at school, children do not consistently make (full) use of them in their spelling.

## References

- Αϊδίνης, Α. 2000. Η χρήση μορφολογικών στρατηγικών στην ορθογραφημένη γραφή. *Πρακτικά συνεδρίου Μάθηση και Διδασκαλία της Ελληνικής ως μητρικής και ως δεύτερης γλώσσας*, 222–236. Ρέθυμνο.
- Αϊδίνης, Α. and Δ. Παράσχου. 2004. Ανάπτυξη ορθογραφημένης γραφής στο Δημοτικό Σχολείο: λάθη και στρατηγικές των παιδιών. *Πρακτικά συνεδρίου Η Γνωστική Ψυχολογία σήμερα: Γέφυρες για τη μελέτη της Νόησης*, 245–251. Αλεξανδρούπολη.
- Bereiter, C. 1980. Development in writing. In *Cognitive processes in writing*, ed. by L. W. Gregg and E. R. Steinberg, 73–93. Hillsdale, NJ: Erlbaum.
- Bruck, M. and G. S. Waters. 1990. An analysis of the component spelling and reading skills of good readers-good spellers, good readers-poor spellers and poor readers-poor spellers. In T.H. Carr and B.A. Levy (eds.), *Reading and its development: Component skills approaches*, 161–206. San Diego: Academic Press.
- Bryant, P and T. Nunes. 1998. Learning about orthography : A cross-linguistic approach. In S. G. Paris and H. M. Wellman (Eds.), *Global prospects for education: Development, culture and schooling*, 171–191. Washington, DC: American Psychological Association.
- Cassar, M. and R. Treiman. 1997. The beginnings of orthographic Knowledge: Children's knowledge of double letters in words. *Journal of Educational Psychology* 89.631–644.
- Chliounaki, K. and P. Bryant. 2002. Construction and learning to spell. *Cognitive Development* 17.1489–1499.
- Deacon, H. and P. Bryant. 2005. What young children do and do not know about the spelling of inflections and derivations, *Developmental Science* 8(6).583–594.
- Διακογιώργη, Κ., Θ. Μπαρής and Θ. Βαλμάς. 2005. Ικανότητα χρήσης μορφολογικών στρατηγικών στην ορθογραφημένη γραφή από μαθητές της Α΄ τάξης του δημοτικού. *Ψυχολογία* 12(4).568–586.
- Διακογιώργη, Κ. Γ. Τασσιοπούλου and Β. Κουρκούτα. 2008. Διερεύνηση γνωστικών και γλωσσικών παραγόντων στις ορθογραφικές ικανότητες των παιδιών. *Νόησις* 4.168–196.
- Fayol, M., M. G. Thevenin, J. P. Jarousse and C. Totereau. 1999. From learning to teaching to learning French written morphology. In *Learning to read: An integrated view from research and practice*, ed. by T. Nunes, 43–63. Dordrecht: Kluwer Academic Publishers.
- Laxon, V. J., V. Coltheart and Keating, C. 1988. Children find friendly words friendly too: Words with many orthographic neighbors are easier to read and spell, *British Journal of Educational Psychology* 4.103–119.
- Morris, D. and J. Perney. 1984. Developmental spelling as a predictor of first-grade reading achievement. *The Elementary School Journal* 84.441–457.
- Nunes, T, P. Bryant and M. Bidman 1997. Learning to spell regular and

- irregular verbs. *Reading and Writing: An interdisciplinary Journal* 9.427–449.
- Perry, C., J. Ziegler and M. Coltheart. 2002. A dissociation between orthographic awareness and spelling production. *Applied Psycholinguistics* 23.3–73.
- Protopapas, A. Tzakosta, M. Chalamandaris and P. Tsiakoulis. 2010. IPLR: an online resource for Greek word-level and sublexical information. *Lang Resources and Evaluation*.
- Siegel, L., D. Share and E. Geva. 1995. Evidence for superior orthographic skills in dyslexics. *Psychological Science* 6.250–254.
- Stage, S. A. and P. K. Wagner. 1992. Development of young children's phonological and orthographic knowledge as revealed by their spellings. *Developmental Psychology* 28.287–296.
- Sterling, C. M. 1983. Spelling errors in context. *British Journal of Psychology* 74.353–364.
- Templeton, S. 1991. Teaching and learning the English spelling system: Re-conceptualizing method and purpose. *The Elementary School Journal* 92.85–201.
- Totureau, C., M-G. Thevenin and M. Fayol 1997. The development of the understanding of number morphology in written French. In *Learning to spell: theory and Practice across Languages*, ed. by C. A. Perfetti and L. M. Rieben Fayol, 97–114. Mahwah, NJ: Lawrence Erlbaum.
- Treiman, R. 1993. *Beginning to spell: A study of first-grade children*. New York: Oxford University Press.
- Treiman, R., D. Berch and S. Weatherston 1993. Children's use of phoneme-grapheme correspondences in spelling: Roles of position and stress. *Journal of Educational Psychology* 85.466–477.
- Treiman, R., M. Cassar and A. Zukowski. 1994. What types of linguistic information do children use in spelling? The case of flaps. *Child Development* 65.1310–1329.
- Varnhagen, C, M. McCallum and M. Burstow. 1997. Is children's spelling naturally stage-like? *Reading and Writing: An Interdisciplinary Journal* 9.451–481.
- Waters, G.S., M. Bruck and M. Malus-Abramowitz. 1988. The role of linguistic and visual information in spelling: A developmental study. *Journal of Experimental Child Psychology* 45.400–421.