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The late acquisition of a major difficulty of French inflectional orthography: the homophonic /E/ verbal endings

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Abstract

The aim of this article is to give an overview of researches about the acquisition of /E/ verb endings in French as a first language. The spelling of this suffixal inflection is a major difficulty of French orthography, because many alternative spellings are available. For example, the single phonological form /paRIE/ can be spelled <parlé>, <parlée>, <parlés>, <parlées>, <parler>, <parlez>, <parlait>, <parlais>, <parlaient>, all of which are frequently used. This spelling difficulty is sustainable and generates strategies from writers who seem to accommodate opposite constraints originating in different linguistic levels of the French writing system. The main findings of a study carried out in school with 621 students from 8- to 14 year-old are presented: the early competition between <é> and <er> inflections, the over-regularization of the agreement with the subject and finally the interaction between the selection of the morphonogram <é> and the overregularization of the agreement with the subject. Ultimately, the data collected show a very long and costly acquisition of the spelling skill that confirms that French writing system is one of the most difficult to master.

The acquisition of writing is quite demanding whatever the language. It is now widely accepted that acquisition is conditioned by the nature of writing systems whose complexities generate strategies from writers. Even for a language with a relatively transparent orthography such as Italian, it is reported that it takes several years to master its spelling: errors to homophones which are spelled in different ways decrease steadily from 74% in Grade 2 to 18% in Grade 5 (Job, Peressotti, & Mulkatto, 2006). It is, therefore, not implausible to propose that it should take much longer to master orthographies reported as “deep”.

Since the early nineties, the focus of acquisition studies moved from phonology to morphology and researchers have begun to pay close attention to the role of written inflectional morphology in the acquisition of writing. Regarding “deep” orthographies, the focus was first put on English and its past tense, but now a lot of studies are available on a wide range of languages (see recently published handbooks, for instance Bryant and Nunes (2004) and Joshi and Aaron(2006)).

The question is therefore: when the basic letter-sound correspondences knowledge is not sufficient, on what type of information do writers rely on when spelling? For instance how may the frequently encountered French error <il/elle envoit> (instead of <il/elle envoie>, “he/she sends”) be explained? One could hypothesize that it could be explained by recourse to a morphemic reason: <t> is the most frequent morphogram in the third person after a vowel sound. But, the final unexpected <t> could also be explained by an interference with the frequently used verb <il/elle voit> (“he/she can see”) as well as by the frequency effect; the sound sequence /vwa/ being written

<voit> in the vast majority of cases. Thus, this highly frequent error can be explained by either a morphemic or a non morphemic spelling strategy.

/E/ French verbal endings are an interesting case because basic letter-sound correspondences knowledge is not sufficient to find the right spelling. Indeed many alternative spellings are available for spelling verb forms ending in /E/. However, although /E/ suffixal inflection is a major difficulty of French orthography, its acquisition has not been studied. The aim of this paper is to provide new data on how grammatical spelling develops from the age of 8 to 14 and to investigate the kind of linguistic knowledge involved in the process of acquisition.

In the first section the linguistic issue will be considered and French writing system specificities will be highlighted in comparison with other writing systems. The second section will consider the production of written morphology. In the third section, we present a study we carried out in which we examined the competition between <é> and <er> inflections, the over-regularisation of the agreement with the subject and finally the relation between the selection of the morphonogram <é> and the over-regularisation of the agreement with the subject. In the last section, results from this study will be discussed.

1. A linguistic approach

1.1. French writing system: a multi-level organisation

To account for the complexity and the diversity of the writing systems, the notion of *mixedness* has been used. Every single writing system, that is « recording language by means of visible or tactile marks », should be viewed as a mixed system (Coulmas, 2003), resulting from the joint application of two principles: the phonographic principle

and the semiographic one (Jaffré, 1997; Jaffré & Fayol, 2006). According to the first principle, the set of units we use when we write is directly linked to the sound chain. If the signs refer to syllables, the system is said *syllabic*. If the signs refer to phonemes, the system is said *alphabetic*. According to the second principle, the semiographic one, the units used when spelling are meaningful. They can either be morphemes or words.

Fayol and Jaffré (2008) classified writing systems using the Latin alphabet according to their level of semiography, from major semiography (i.e. deep orthography: English, French, Danish) to minor semiography (i.e. shallow orthography: Spanish, Hungarian, Finnish). They highlighted that the more recent systems are the more transparent and that learning is about twice as slow in deep orthographies. English and French are examples of the “major semiographies” but, according to Jaffré, English is the most spectacular instance of orthographical deepness (2008: 99), generating more difficulties in reading than in spelling, whereas French is more difficult to spell than to read. The French language has, therefore, a deep writing system, being more difficult to write than to read.

French semiography deserves to be clarified. Catach (1986) described French orthography as pluri-systemic and identified four categories of graphemes. First, the category of phonograms represents from 80% to 85% of graphemes used in French. Second, the category of morphograms includes derivational morphemes (<t> in <petit> ‘small’ which relates the word to the feminine form of the adjective <petite>), and inflections (second person <s> in <tu parles> ‘you speak’; <ai> imperfect mark in <tu parlais> ‘you were speaking’). Third, the so-called logograms, units that are most of the time monosyllabic, refer to “word specific” spelling forms which oppose homophonic but

not homographic units (e.g., all <ou>/<où> both pronounced /u/ ‘or’/’where’; <temps>/<taon>/<tant>, all three of which are pronounced /tã/ ‘time’/’horsefly’/’so much’). Finally the fourth category, is that of historical or etymological graphemes, whose knowledge depends on the writer’s knowledge about the history of the language. The first category (phonograms) is related to the oral chain and has no linguistic meaning. The three other categories (morphograms, logograms and historical graphemes), do have a linguistic meaning, and constitute the semiographic part of the French writing system. Some semiographic marks are both linked to the sound chain and have a morphological meaning (e.g., past participle –é in <parlé>, imperfect –ai in <parlais>, linked to the /E/ phoneme;) whereas others are mute letters conveying morphological meaning without a sound counterpart (e.g., second person <s> in <tu parlais>).

When constructing the orthographic processes and representation of written words, the learner may use knowledge from these different levels.

1.2. Deep orthography, homophony and spelling

When writing in deep orthographies such as French, but in other languages as well, spellers are confronted with two main sources of difficulty: firstly, there are alternative spellings for a phoneme or chain of phonemes and secondly, some written signs have no spoken counterpart. In Greek, for instance, the vowel /o/ can be spelled in two different ways, and the vowel /i/ in six different ways. In some cases, the correct choice is determined by morphology, especially in inflections: /o/, for instance, can be spelled as <o> at the end of singular neuter nouns and <ω> at the end of first-person

singular verbs; the most frequent ways of spelling /i/ are: <η> for feminine nouns and adjective inflections in the singular, nominative case; <ι> for neutral noun inflections in the singular, nominative case; <οι> for masculine nouns and adjective inflections in the plural, nominative case; <ει> for part of the verb inflection in the third-person-singular present-tense passive voice (Nunes, Aidinis, & Bryant, 2006). An even more complex case is when homophonic morphemes are different in spelling though related to the same morphological class of lexical units. In this case the proper spelling depends on the sentence context in which the morpheme appears. Dutch (Bosman et al., 2006) or Danish (Elbro, 2006) present this difficulty. In Dutch, for example, the first, second and third person of weak verbs are phonologically identical in the present tense: for instance <verbrand> (I burn) / <verbrandt> (You burn; he/she burns), though spelled in a different way, sound the same. The same pattern is frequent in French. Four forms out of the six persons of the present tense of the so-called first group verbs sound the same but are spelled in three different ways: for example /parl/ from the verb <parler> (to speak) is the unique pronunciation corresponding to three spellings: <(je/elle/il) parle> ‘I/she/he speak(s)’, <(tu) parles> ‘you speak’ and <(elles/ils) parlent> ‘they speak’. Regarding reading, it has been shown that orthographic information without oral cues help but take more time to be processed than grammatical morphemes with a phonological status (see Brysbaert et al., 2000, for Dutch; Frenck-Mestre et al., 2008, for French). In numerous occurrences of context-dependent spelling, the useful linguistic information is based on the syntactic phenomenon of agreement. For French, the main agreement which determines the spelling of a conjugated verb form is subject-verb agreement.

Thus, in languages such as Greek, Dutch, Danish, French, choosing the right spelling requires morphosyntactic knowledge.

1.3. /E/ French verbal inflections

Regarding /E/ French verbal endings, which form the focus of this paper, the two difficulties seen above, that is, alternative spellings for a sound chain and mute letters, are cumulated, generating a great complexity, especially for the first group verbs whose written inflections are <er> for the infinitive and <é> for the past participle, both pronounced /E/. In addition, four out of six persons of the imperfect tense require the –ai- inflection which is pronounced /E/ as well (Walter, 1982). Finally, mute graphemes complete the past participle and imperfect inflections in order to carry information about gender, number, and person. As a consequence, a single oral form such as /parle/ results in eight different and frequently written forms: <parler> (infinitive); <parlé>, <parlés>, <parlée>, <parlées> (past participle respectively masculine singular, masculine plural, feminine singular, feminine plural); <parlais>, <parlait>, <parlaient> (imperfect respectively person 1 and 2, 3, 6). This maximalist differentiation of the suffixal inflection has gradually happened as the phonological level of spoken language was evolving (Pellat & Andrieux-Reix, 2006). The last evolution to be signalled is still in progress. It concerns the neutralization of the unstable phonological opposition between /e/ and /ɛ/, which leads to a state of generalized homophony-heterography; the majority of French speakers, especially in France, no longer make the phonological difference between the imperfect (<il parlait> ‘he was speaking’) and the infinitive (<parler> ‘to speak’) when they speak. It is the reason why the transcription of the neutralised phoneme is /E/.

It is therefore a real hurdle both for adults and children to write a /E/ verbal ending. This difficulty has been raised a long time ago in studies carried out both in primary and secondary schools in Quebec (Préfontaine, 1973), Switzerland (Roller, 1954) and France (Dolla & Establet, 1973; Chervel & Manesse, 1989). But, these studies just provide number of errors without investigating their nature, nor the procedures used by the students.

More recently, Brissaud and Sandon (1999) and Brissaud and Chevrot (2000) analysed errors made by 11 to 15 year-old French students when asked to write past participle, infinitive and imperfect forms. Four trends in errors were noted:

- 1/ marking the verbal form for the gender and the number of the preceding form, would it be the subject (<Ils ont mangés du chocolat>, instead of <mangé> ‘They have eaten chocolate’) or other (<Jacques les espionnaient avec des copains>, instead of <espionnait> ‘Jacques was spying on them with friends’);
- 2/ writing <é> instead of <er> or <ai>, as in <Elle alla les cherché>, instead of <chercher> (‘She went to fetch them’);
- 3/ not agreeing the past participle with the direct complement placed before the verb when used with the *avoir* auxiliary, as in <Elle ne les avait jamais fermé, ses volets> instead of <fermés> ‘She had never shut her shutters’.

The present study will provide new data relevant to the first two tendencies. More precisely, we aim to describe the development of these trends from 8 to 14 years, and hypothesize about the linguistic conditions which account for the observed pattern of results.

2. The acquisition of /E/ final verbal endings in French: which levels of knowledge could be implicated?

From a linguistic analysis, it can be concluded that, in order to produce a /E/ verb ending, a double selection of written units has to be done without the help of phonological oppositions: a grapheme of mode-tense-aspect (<ai>, <e>, <er>) corresponding to the phoneme /E/, according to knowledge of verbal paradigms (imperfect, infinitive and past participle) and a grapheme corresponding to person, number or gender (<e>, <s>, <t>, <ent>), that depends on agreement.

But how spellers actually process written units is not necessarily the same as processes suggested by linguistic analysis. Moreover, other knowledge is involved in the acquisition and production of written morphology, as far as words that end in sounds that can be spelled in more than one way are concerned. Previous work suggests other types of knowledge involved in the acquisition of written morphology that spellers can rely on.

2.1. At the early stages of spelling acquisition, children appear to use phonographic rather than morphological information.

Young children tend to adopt mostly single letters as the only representation of phonemes and digraphs seem to cause them a great deal of difficulty. As an example, Nunes, Aidinis and Bryant (2006) found that Greek children from Grades 2 and 3 are single pattern users or indiscriminate users of two or more patterns. These two categories accounted for the spelling of Greek words ending in /i/ and represented 80% of the spellings produced in Grade 2 and 50% in Grade 3.

Children who were able to use written morphology were in the minority. There was a marked increase in the use of written morphology from Grade 4 onwards.

Based on the above observations, we would expect that young children should write <é> in order to spell /E/ instead of <er> or <ai>. Not only is this single grapheme the most frequent way of spelling /E/ (Ghneim, 1997), the probability for children to come across a past participle in <é(es)> is higher than the one to come across an imperfect or an infinitive (imperfect: 0.04; infinitive: 0.03; past participle: 0.07; Lété, 2006). Thus, this distribution suggests that <é> is the most likely /E/ inflection.

2.2. At some stage, children generalize morphological marks. Totereau et al. (1998) showed that the <s> mark for nominal plural is overextended to verbs by children; for example <ils trouvent> ‘they find’ is spelled <ils trouves> and the –nt mark for verbal plural is then overextended to nouns and adjectives (for example <étranges> ‘strange’ is spelled <étrangent>). This effect is moderated by the frequency: children are more prone to use an incorrect <s> mark when the noun exists; from Grade 3 onwards, they are more likely to add <s> to verbs that have a homophonous noun that is more frequent than the noun (*timbre* ‘stamp’ for example; <ils timbrent> is often spelled <ils timbres>).

Regarding the production of /E/ verb forms, previous work from the authors (Brissaud & Chevrot, 2000) showed the avoidance of prohibited sequences from Grade 5 onwards. When children want to mark verbs as plural, they very seldom produce prohibited forms ending with <éent> and they avoid existing forms such as final <ais> (which is a mark for imperfect, person 1) or <ers> (which is a possible plural form for nouns, for instance <les diners>). Thus, there is no prevalent plural marker. Children have learned to combine a grapheme of mode-tense-aspect (<ai>, <é>, <er>) and a

grapheme corresponding to number (<s>, <t>, <ent>). We thus predicted that the confusion of marks should be related to /connected to / depend on the paradigms.

2.3. Children could memorize frequent inflected forms and retrieve them directly from memory. Within the framework of connectionist models, acquisition of word knowledge is viewed as developing as soon as children are exposed to the written forms of words. Harm and Seidenberg's reading model (2004) highlighted the role of orthography and visual processes in disambiguating the many homophones in language. However, the efficiency of visual processes takes time to develop. Largy et al. (2007) controlled for the reading input and the number of times children wrote singular and plural nouns in French and showed that writing correctly inflected nominal forms was related to the frequency with which children from Grade 1 and Grade 2 had been exposed to these forms; for instance a noun frequently read and written in the plural form was written more accurately in the plural form than in the singular one. Thus, inflected units could be retrieved from memory. Such an effect was shown as well in Dutch speaking adults (Sandra, Frisson, & Daems, 1999) and teenagers (Frisson & Sandra, 2002).

As far as /E/ forms are concerned, Fayol and Pacton (2006) showed it was easier for adults to write the infinitive form of a verb which is most of the time read in its infinitive form than in its past participle one. Brissaud, Chevrot and Lefrançois (2006) reached this conclusion both for <er> and <é> finals in Grade 3 and 5 but the statistical effect seemed to decrease as the capacity to produce inflections adapted to the context increased. Thus, some frequent /E/ verb forms, especially infinitive ones, could be retrieved from memory.

2.4. Children may make use of local information as well, or in addition. So-called attraction errors have been highlighted by Bock and colleagues for spoken English (Bock & Miller 1991; Bock, Eberhard, & Cutting, 2004); and by Largy and colleagues for written French (Largy, Fayol, & Lemaire, 1996).

As far as /E/ verb forms are concerned, this effect has been noted for the imperfect, for instance in <Jacques les espionnaient> instead of <espionnait>, ‘Jacques spied them’; Brissaud & Sandon, 1999). This attraction error can work as well when the unit situated just before the verb is the subject. As an example, students often make the agreement with the subject whereas they are not supposed to do so (<ils ont passés l’examen> instead of <ils ont passé> ‘they took the exam’). This type of error was observed as well when the target was an infinitive, for instance in <elles vont passées> instead of <elles vont passer> ‘they are going to pass’ (Brissaud & Chevrot, 2000). The error may find its origin in the fact that agreement of the past participle varies according to the auxiliary it is used with: with the *être* auxiliary, agreement is made with the subject (<ils sont passés> ‘they passed’) whereas it is not the case with the *avoir* auxiliary though syntactic contexts may look very similar. And, it was shown that students from Grade 4 onwards succeed in making the agreement of the past participle used with the *être* auxiliary whereas it is not the case with the *avoir* auxiliary (Fayol & Pacton, 2006).

2.5. Morphosyntactic awareness may affect the spelling of morphemes. Nunes, Bryant and Bindman (1997) showed in a longitudinal study that children first spell phonetically but then realize that basic phonographic relations are not sufficient

information to produce the right English spellings. They enlarge their repertoire but without really understanding the grammatical status of the new graphemes they use. Later they apply the correct morpheme to grammatical classes and this is related to their morphosyntactic awareness. The involvement of morphological reasoning was highlighted in studies that showed that children develop their own hypotheses about writing (Brissaud & Sandon, 1999).

In conclusion, as far as verb endings in /E/ are concerned, it can be said that different kinds of knowledge could be used in spelling by children. It can be hypothesized that children first use phonographic procedures and then move to morphological ones. The aim of the present study was to document this movement in 8 to 14 year-olds. Specifically, our study tested the hypothesis of the influence of the frequency of phonographic correspondences and its development, the overgeneralization of the agreement and its development, and possible interactions between these two trends.

3. A cross sectional study of the development of spelling errors in French

Participants

Because French national assessment results show that children have difficulties both at the beginning of Grade 3 and at the end of primary school, six different consecutive age levels were chosen.

Our sample consisted of children tested in France (Grenoble) and in Canada (Montreal): 621 children from the 3rd year of elementary school to the 8th school-year (in France Grade 3 to Grade 5 in primary school, and 1st to 3rd year of secondary school ; in

Canada, Grade 3 to Grade 6 in primary school ; 1st to 2nd year of secondary school). Participants took the spelling test at the end of the school year in Grenoble (n = 318 students; average age: 11;7) and Montreal (n = 303 students; average age: 11;9). All were French native speakers. As the system is somewhat different in France and in Quebec, the six consecutive age levels we used will be called Grade 3, 4 and 5, 6th year, 7th year and 8th year.

Procedure

A protocol controlled from the frequency and syntactic structure point of view was developed for use with the 8 to 14 year-olds (see Appendix 1). The test which students were given consisted of 48 sentences presented in two booklets of 24 sentences each, with one sentence printed on each page. Students were asked to write down the missing words in the blanks: either a *passé composé* constructed with the <avoir> auxiliary (for instance <ont quitté> in the sentence <Les garçons ont quitté le jardin>, ‘The boys left the garden’) or a semi-auxiliary followed by an infinitive (for instance *doit chercher* in the sentence <Capucine doit chercher un livre> ‘Capucine has to look for a book’. The syntactic frame of each sentence was subject - verb - direct object and the direct object was always masculine and singular. There were four subjects representing the four combinations for number and gender: <Quentin> (masculine singular), <Capucine> (feminine singular), <les filles> (feminine plural), <les garçons> (masculine plural). Each subject was presented 6 times for both targets (<é> vs. <er>). The verbs were controlled for overall frequency (Content, Mousty, & Radeau, 1990) for each subject and target. The test was administered twice, on two consecutive days. In the

following analysis, only the inflection was analyzed. Of the 29808 answers collected, 10444 (35%) were erroneous. The <er> and <é> answers represented 92.4% of the errors. The 7.6% remaining errors included 423 <ai> forms (<ai>, <ais>, <ait>, <aient>), 268 others, and 104 no-answers. As a preliminary analyses showed no differences in trends observed in the two countries, the analyses reported here collapse across this variable.

3.1. The competition between <é> and <er> inflections

Of initial interest was the capacity to produce the right modal morphogram, whatever the final morphogram. Table 1 shows the availability of each inflection: the average rate of <er> forms (including <ers>) when the target is <er> and the average rate of <É> forms (including <ée>, <és> and <ées>) when the target is <é>.

	Grade 3	Grade 4	Grade 5	6 th year	7 th year	8 th year
Target <er>: percentage of <er> forms (including <ers>)	65,3 (33)	60,3 (33.8)	63.3 (36.5)	63.70 (36.6)	70.4 (33.3)	84.5 (33.3)
Target <é>: percentage of <é>forms (including <ée>, <és>, <ées>)	37.1 (35.1)	81.2 (24.5)	90.1 (15.4)	87.3 (21.2)	90 (20)	93,7 (15.9)

Table 1. Evolution in the percentage of <er> forms (including <ers>) when the target is <er> and the number of <É> forms (including <ée>, <és> and <ées>) when the target is <é> (standard deviation in brackets).

A Grade (3, 4, 5, 6th, 7th, 8th) by target (<er>, <é>) Anova was performed on answers compatible with the target; it revealed a significant effect of the school level ($F > 7.643$; $p < 0.0001$; $\eta^2 = 0.27$), of the target ($F = 224.258$; $p < 0.0001$; $\eta^2 = 0.08$) and their interaction ($F = 7.113$; $p < 0.0001$; $\eta^2 = 0.17$).

Students improve from Grade 3 to the 8th year for both targets ($F(1,615) > 17$; $p < .00003$; Fisher's PLSD post hoc tests were used to test all pairwise comparisons). In Grade 3, the right selections of the <er> morphonograms are more numerous than the

right selection of the <é> one. From Grade 4 onwards the trend reverses in each school level ($F(1,615)>22$; $p<.00001$): it becomes easier to write <é> than to write <er>.

	Grade 3	Grade 4	Grade 5	6 th year	7 th year	8 th year
Target <é>: percentage of <er> forms (including <ers>)	56.2 (36.2)	16.9 (22.8)	7.6 (13.4)	6.6 (12.6)	9.1 (19)	5.2 (14.1)
Target <er>: percentage of <é>forms (including <ée>, <és>, <ées>)	27.8 (31.1)	36.9 (34)	34.2 (34.4)	32.7 (35.3)	28 (32.4)	14.7 (24.3)

Table 2. Evolution in the percentage of <er> forms (including <ers>) when the target is <é>, and in the percentage of <É> forms (including <ée>, <és> and <ées>) when the target is <er> (standard deviation in brackets).

In table 2, the average rate of É forms when the target is <er> is shown and vice versa. The Anova performed on answers incompatible with the target revealed a significant effect of the school level ($F>6.548$; $p<0.0001$; $\eta^2 = 0.17$), of the target ($F=51.721$; $p<0.0001$; $\eta^2 = 0.08$) and their interaction ($F 25.198$; $p<0.0001$; $\eta^2 = 0.25$).

Each type of errors decreases from Grade 3 to 8th year ($F(1,615)>8$; $p<.002$). In Grade 3, answers of the type “<er> replaces <é>” are more numerous than “<é> replaces <er>” ones ($F(1,615)=47$, $p<.000001$). From Grade 4 onwards the trend reverses: at each school level, the “<é> replaces <er>” errors become more frequent than the opposite ones ($F(1,615)>5$; $p<0.02$).

The developmental pattern that results from these tests is simple. In Grade 3, the <er> inflection is more available than <é> one. From Grade 4 onwards, the <é> inflection takes over and becomes prevalent in correct answers and errors. This increase in the availability of <é> goes together with an increase in the “<é> replaces <er>” errors from Grade 3 to Grade 4 ($F(1,615)=4.2$, $p=.041$), followed by a stagnation of this type of errors until 7th school-year ($F(1,615)<1.1$, $p>.30$) and a decrease from 7th to 8th year ($F(1,615)=9.17$, $p=.0025$).

It could happen that children overgeneralize one of the two inflections and produce it either correctly or incorrectly. We verified this conjecture by calculating Spearman correlations involving errors and correct selections (table 3).

	Grade 3	Grade 4	Grade 5	6 th year	7 th year	8 th year
1/ Correlation between correct <é> answers and errors of the type “<é> replaces <er>”	+0.812 ****	NS	-0.318 **	NS	NS	-0.245 **
2/ Correlation between correct <er> answers and errors of the type “<er> replaces <é>”	+0.811 ****	NS	-0.253 *	NS	NS	NS
3/ Correlation between correct <é> answers and correct <er> answers	-0.682 ****	NS	+0.467 ****	+0.209 *	+0.218 *	+0.534 ****
4/ Correlation between errors of the type “<er> replaces <é>” and errors of the type “<é> replaces <er>”	-0.746 ****	NS	+0.411 ****	NS	NS	+0.483 ****

Table 3 – Spearman correlations between correct selection of <er> and <é> and incorrect ones * $p \leq 0.05$;

** $p \leq 0.01$; **** $p \leq 0.0001$

In Grade 3, the positive or negative signs of correlations show the expected relationship. Children who produce many correct/expected <é> forms are also those who produce many “<é> instead of <er>” errors (line 1). Similarly, those who produce many correct <er> forms are also those who produce more “<er> instead of <é>” errors (line 2). The result is an inverse relationship as well between correct answers, if they are numerous in <er>, they are rare in <é> (line 3) as between errors, if a child is wrong on many <er>, he errs slightly on <é> (line 4). In Grade 5, the sign of correlations reflects a more traditional overall performance in spelling: those whose performance is high

perform well for both modes (line 3) and slightly err for both modes (line 4). Those who do well in a mode slightly err in the other one (lines 1 and 2).

In summary, though certain correlations are not significant in table 3, what happens in two key stages, Grade 3 and Grade 5, can be highlighted. Everything suggests there are two types of writers in Grade 3: those who prefer the <er> inflection and use it consistently; those who prefer <é> and produce it consistently as well. In Grade 5, this division would disappear in favor of a more conventional distinction between those who know how to select the morphonogram according to the context and those who do not perform with the same efficiency. Since the analysis of variance revealed that <er> is more broadly available in Grade 3, we must conclude that writers promoting <er> are more numerous at an early stage. We verified this second conjecture by counting the students according to their preferences, in correct answers and errors (table 4).

		Grade 3	Grade 4	Grade 5	6 th year	7 th year	8 th year
Correct answers	-é > -er	30 %	64 %	73 %	62 %	71 %	44 %
	-er > -é	67 %	26 %	10 %	22 %	16 %	14 %
Errors	-é > -er	30 %	62 %	74 %	62 %	70 %	45 %
	-er > -é	67 %	27 %	10 %	16 %	16 %	12 %

Table 4 – Distribution of the subjects according whether the number of <é> answers they produce is less than or greater than the number of <er> answers

In Grade 3, the majority of students (67%) produced more accurate <er> answers than <é> answers. This trend remains true for errors, since a majority (67%) produced more often erroneous <er> forms than erroneous <é> forms. From Grade 4 onwards, the

trend is reversed, the majority (62%) of children producing more often <é> than <er>, both in correct forms and errors.

A developmental scenario is gradually taking shape: in Grade 3 the <er> inflection is more available to a majority of students and it is overgeneralized. It drives students towards correct answers when the target is <er> and errors when the target is <é>. From Grade 4 onwards, the <é> inflection becomes more available than earlier and it is overgeneralized in turn, which allows correct answers as well as errors on the <er> target. At any level, some students show opposite trends, preferring <é> in Grade 4 and <er> onwards.

3.2. The agreement

Another goal of this study was to investigate the way the trend to make the agreement with the subject evolved. The data collected in France and in Quebec enabled the quantification of this trend.

	Grade 3	Grade 4	Grade 5	6 th year	7 th year	8 th year
Target <é>: percentage of <é> forms matching gender and number of the subject	5 (10.6)	18.3 (27.9)	23.9 (28.9)	32.2 (28.2)	28.3 (28.3)	19.4 (17.9)
Target <er>: percentage of <é> forms matching gender and number of the subject	3.3 (14.2)	13.9 (33.3)	17.2 (33.2)	18.9 (35.6)	17.8 (36.2)	7.8 (28)

Table 5. Selection of <ée>, <és>, <ées> inflections that match the subject gender and number (standard deviation in brackets).

Table 5 shows the frequency of answers that are marked with the gender and number of the subject for the <er> target (the upper line, for instance <Capucine doit cherchée un livre> instead of <chercher>, ‘Capucine must look for a book’) and the <é> target (the lower line, for instance <Les garçons ont quittés le jardin> instead of <quitté>, ‘The boys have left the garden’). We removed from the data the sentences whose subject

was *Quentin*, a masculine first name, as the agreement with the subject in this case results in the correct answer. As a consequence, the results in figure 3 are based for both targets on 18 sentences in which the subject is either feminine singular (expected error : <ée>), or feminine plural (expected error: <ées>), or masculine plural (expected error: <és>)

The Anova that was performed on answers marked with the gender and number of the subject revealed a significant effect of the school level ($F > 6.832$; $p < 0.0001$; $\eta^2 = 0.08$), of the target ($F = 49.813$; $p < 0.0001$; $\eta^2 = 0.08$) and their interaction ($F = 2.42$; $p = 0.035$; $\eta^2 = 0.02$).

For both targets, the evolution of the error scores shows a typical shape of the regularisation processes, an increase followed by a decrease. Regarding <er>, the number of <ée>, <és> et <ées> inflections that match the gender and number of the subject increases from Grade 3 to Grade 4 ($F(1,615) = 9.72$, $p < 0.002$), plateaus from Grade 4 to the 7th year ($F(1,615) < 1.14$, $p > 0.28$) and then decreases from the 7th to the 8th year ($F(1,615) = 8.66$, $p < 0.004$). As far as <é> target is concerned, the trends are identical increasing from Grade 3 to Grade 4 ($F(1,615) = 9.39$, $p < 0.002$), plateau from Grade 4 to the 7th year ($F(1,615) < 3.2$, $p > 0.075$) and decreasing from the 7th to the 8th year ($F(1,615) = 4.0$, $p < 0.05$).

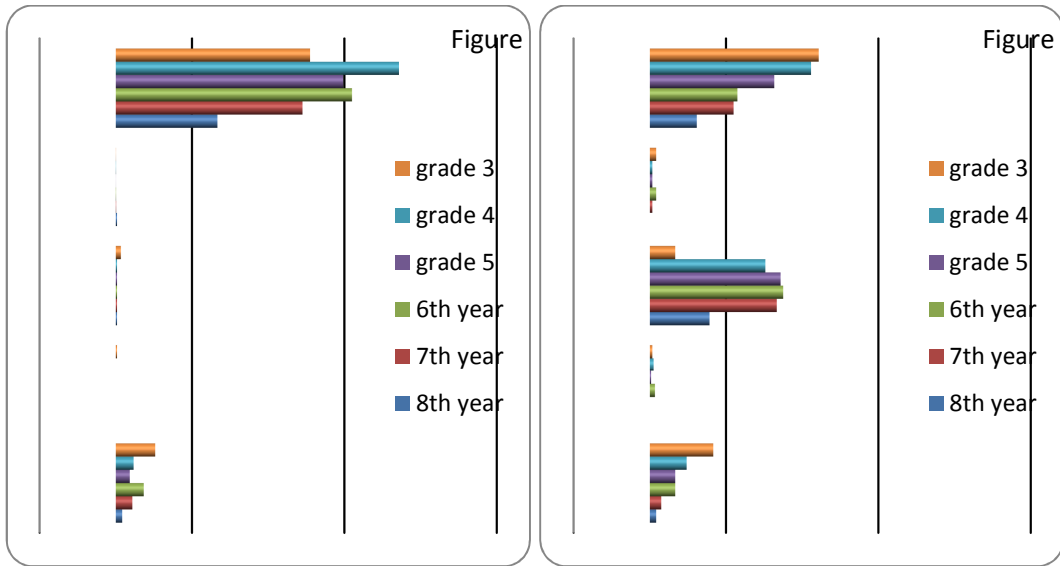
It should be noted that in Grade 3 the children's answers that match the gender and number of the subject are not different for both targets ($F(1, 615)$, $p = .5$). In Grade 4, this type of answer is more frequent with the <é> target than with the <er> target (the difference is marginally significant: ($F(1, 615) = 3.04$, $p = .08$); this difference becomes significant from Grade 5 onwards ($F(1, 615) > 5.20$, $p < .03$). The differences in error rates could be explained by the fact that the construction of the past participle used with the

avoir auxiliary looks like the one used with the *être* auxiliary for which the writer has to produce gender and number concord with the subject (for example, in <ils sont allés>, the past participle <allés> is agreed with the subject <ils>).

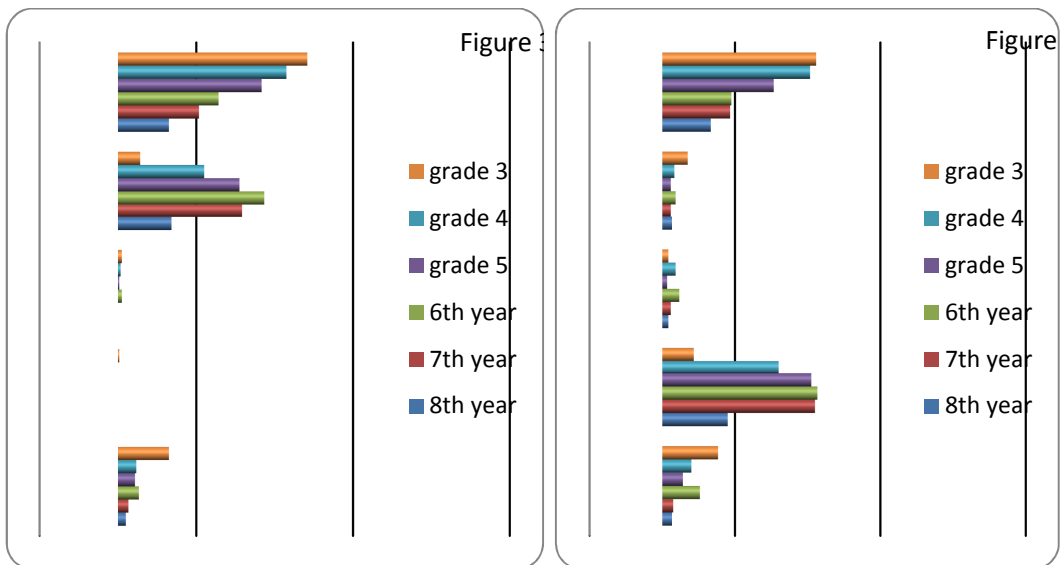
It is thus clear that the trend to make the agreement with the subject becomes stronger from Grade 3 to Grade 4, that it then stabilises, then decreases from the 7th to the 8th year. The trend to replace the target <er> with the <é> inflection followed by <s> or <e> suggests that there should be a relation between the selection of the morphonogram and the agreement that does not conform to the norm.

3.3. Relation between the selection of the morphonogram and the over-regularisation of the agreement with the subject

To test this hypothesis of a relation between the selection of the morphonogram <é>, prevalent from Grade 4 onwards and the agreement **with the subject**, the focus will be put on the different types of errors made when the target was <er>. Figures 1, 2, 3 and 4 show the dynamics of these two trends, showing the evolution of the different types of errors for each of the four subjects (<Quentin>, <Capucine>, <les filles>, <les garçons>). In each figure, each bar refers to the percentage of errors of a particular type at a given school level.



Figures 1 and 2. Evolution in the percentage of the main types of errors for the subjects <Quentin> (figure 1), and <Les garçons> (figure 2), for the <er> target.



Figures 3 and 4. Evolution in the percentage of the main types of errors for the subjects <Capucine> (figure 3), and <Les filles> (figure 4), for the <er> target.

In figures 2, 3 and 4, it is quite clear here that errors polarize into two types: non-marked <é> forms and <é> forms agreed with the subject (<és> for the subject <les garçons>, <ée> for the subject <Capucine>, <ées> for the subject <les filles>). When the subject is <Quentin>, the non-marked <é> form is the one that carries the number and gender of the subject. Thus, only one type of error was expected in figure 4.

We performed two Anovas for each of the three subjects <Capucine>, <les filles> et <les garçons>: the dependant variable was either the percentage of <é> forms or the percentage of <é> forms marked with the gender and number of the subject.

The three Anovas performed on the percentage of <é> forms showed that <é> replacement errors globally varied with school-level whatever the subject ($F(1, 615) > 7.445$; $p < 0.0001$). Fisher's PLSD post hoc comparisons showed that the difference was situated for the three subjects between Grade 3 and 6th, 7th and 8th years; between Grade 4 and 6th, 7th and 8th years; between Grade 5 and 8th year. For the three subjects <Capucine>, <les filles> et <les garçons>, the <é> forms are numerous in Grades 3 and 4 and then decrease from Grade 5 to the 8th year.

The Anova performed on the percentage of <é> forms marked with the gender and number of the subject showed that this type of error varies with school-level whatever the subject <Capucine>, <les filles> or <les garçons>: ($F(1, 615) > 5.623$; $p < 0.0001$). Fisher's PLSD post hoc comparisons revealed that there was a significant difference for the three subjects between Grade 3 and Grade 4, Grade 5, 6th year and 7th year; between 8th year and Grade 5, 6th year and 7th year. There was moreover a difference between Grade 4 and 6th year for the subject <Capucine>; a difference between Grade 4 and 8th year for the subjects <les garçons> and <les filles>. These <é> forms

marked with the gender and number of the subject are therefore not numerous in Grade 3 and 4; they soar in Grade 4, form a plateau from Grade 4 to the 7th year and then decrease in the 8th year. This pattern is identical to that of the regularizations observed in morphological development, as previously commented.

The trend to use the non marked inflection when the target is <er> decreases between Grade 3 and the 8th year. Conversely, the tendency to use inflections marked with the gender and the number of the subject evolves following a pattern of overgeneralization. This contrast informs the choice of hypothesis to explain the link between <é> inflection and marks for agreement.

According to the first hypothesis, the selection of <é> would authorize the use of the marks <e> and <s> typical for plural and feminine. In some way, the inflection <é> would give writers the opportunity to use the marks <s> and <e>, in response to their emerging trend to make the verb agree with the subject. If this hypothesis were correct, the evolution of the distribution of the marks <é>, <és> and <ées> should follow the evolution of the selection of <é>. We have seen that this is not the case.

According to the second hypothesis, it is the propensity to make the verbal form agree with the subject that would motivate the choice of <é>. Indeed, the writers avoid impossible or improbable inflections, such as forms in <ers> (Brissaud & Chevrot 2000). The use of inflected forms in <é(es)> enables the constraint of agreement, without violating that prohibition, to be satisfied. It is made all the more easily as the structure semi-auxiliary + infinitive (for instance in <Quentin va manquer le train>) looks like the structure <avoir> auxiliary + past participle (<Quentin a manqué le train>) and as the pupils manage the agreement with the <être> auxiliary from Grade 4 onwards (Fayol &

Pacton, 2006). Our data are consistent with this second hypothesis. Indeed, the unmarked answers decrease from Grade 3 to the 8th year; in the same time the use of -é increases from Grade 3 to Grade 5 when it is marked in number and gender of the subject. It seems that the gradual increase of <ée>, <és> or <ées> should be more related to the agreement than to the only propensity to use <é> transcribing /E/.

4. Discussion

This article aimed at giving an overview of the acquisition of /E/ verbal endings, a major difficulty of French orthography, and at discussing the results in the light of recent research on the acquisition of written morphology. Our originality is to provide a developmental view of the acquisition of /E/ spellings and to begin to answer a more general question: on what type of information do writers rely on when several possible and frequent homophonous inflected forms of the same verb are available? The focus was put on late acquisition, once simple letter-sounds are mastered. Moreover, a model of acquisition stages of the /E/ spellings was proposed.

The developmental sequence we found is quite clear: in Grade 3, <er> is more available than <é> to a majority of students. Thus they make mistakes when the target is <é> and produce the correct spelling when the target is <er>. From Grade 4 onwards, <é> becomes more available than <er> to a majority of students. In the same time, the trend to make the agreement with the subject increases. Indeed the number of answers marked with number and gender of the subject grows up in Grade 4 and 5, whatever the target. This general trend to make the agreement with the subject leads to the selection of <é> instead of <er>, the students having understood that the plural and the feminine endings

<s> and <e> cannot be combined with the infinitive inflection <er>.

This evolution is interpreted as a progressive morphologization. Previous research on the acquisition of other writing systems showed that in the early stages simple and frequent graphemes stand out when there are alternative spellings for one phoneme (Bryant, Nunes, & Aidinis, 1999; Erlbro, 2006). Indeed the observation of spontaneous writings of the /E/ verbal ending in Grade 1 suggests that the <é> grapheme is the most frequent spelling. In Grade 3, the use of the <er> morphogram by a majority of students could be related to the emergence of a grammatical awareness which treats differently nouns and verbs. It is hypothesized that the childrens' improving comprehension of what grammatical categories are could lead them to use the <er> ending. Indeed, the infinitive inflection <er> characterizes the most frequent class of verb in French (Riegel, Pellat, & Rioul, 2009: 467). Therefore, in Grade 3, the pupils could write <manger> in <il a manger> because they grasped that <er> is the typical ending of the category of verbs. This hypothesis is confirmed by metagraphic comments during which children say they decided to write <er> “because it was a verb” (Brissaud & Sandon, 1999). An alternative explanation could be the teaching of the analogical procedure that helps to grasp whether the form to be written is an infinitive or an inflected form: if one does not know how to write the verb [pase] in [ilvõpase] and if one can replace it by an infinitive, for instance <Ils vont courir> ‘They are going to run’, one must write the infinitive form <ils vont passer> ‘They are going to pass’. But should it be the case, why would children make <er> errors? The analogical procedure should help them to write <er> when requested and not to write it when not requested. From Grade 4 onwards, students move to a morphosyntactic conception: they understand that the verb varies in gender, person and

number, according to the agreement with the subject. The <é> ending allows the pupils to mark the verb form for gender and number in respect of morphogram associations. In effect, the plural <s> and the feminine <e> morphograms can be combined with <é> inflection, whereas the associations <er> + <s> is not allowed at the end of verbs and the <er> + <e> one unthinkable. It is the reason why students frequently write <Ils vont mangés> instead of <Ils vont manger(s)>. At this stage, the ending <é> is not used as the most frequent grapheme standing for the phoneme /E/, but as a basis for implementing the morphological marks of plural and feminine which are required by the subject-verb agreement. This trend to replace <er> with <é> in order to mark the verb form for gender and number is prevalent at the end of primary school and at the start of secondary school but it seems to be in decline from the 3rd year of secondary school. It was however reported in highly educated adults (Lucci & Millet, 1994).

The errors collected in our studies reflected an incomplete analysis of morphosyntax (Nune & Bryant, 2009). Students have analyzed the verb form as a form varying according to the number and gender of the subject. Moreover, they know that certain morphogram associations are possible at the end of the verb whereas others are forbidden. But they have not grasped that the subject-verb agreement is only possible with <être> auxiliary and when the simple tenses are used. The interaction of these incomplete pieces of linguistic knowledge leads them to the pattern of errors highlighted in our study.

Our study contributes to the understanding of processes involved in complex areas of writing systems and suggests that the slow learning of linguistic forms is related to the knowledge of grammatical information. This process is a gradual satisfaction of

multiple constraints arising from the different aspects of the writing system. The data accounted for show a very long and costly acquisition, which confirms that the morphography makes the French writing system one of the most difficult to master. Although it is clear that we should not expect students to master this point by the end of elementary school, the French educational system (Ministère, 2008) denies how difficult it is to learn the semiographic parts of the spelling system. We have now to change our way of looking at the late acquisitions children go through and to think of educational implications. This series of studies has open the way for future research that should provide more in-depth explorations for the understanding of the late acquisition of spelling in such complex areas.

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Appendix 1

1. Quentin a montré le chemin.
2. Capucine doit danser un tango.
3. Capucine a scruté l'horizon.
4. Les filles vont garder le lit.
5. Quentin a aidé son copain.
6. Les filles vont assaisonner le plat.
7. Les garçons ont quitté le jardin.
8. Les filles ont trouvé un prétexte.
9. Capucine a caché le chat du voisin.
10. Les garçons doivent troquer un jeu contre un disque.
11. Capucine a manipulé le pantin.
12. Les filles vont former un groupe.
13. Les garçons doivent gagner le match.
14. Les filles ont sélectionné un film.
15. Quentin va tester un produit nouveau.
16. Les garçons ont confectionné un déguisement.
17. Les garçons doivent décommander le repas.
18. Capucine a posé son appareil.
19. Les filles ont causé un accident.
20. Quentin va décortiquer un crabe.
21. Capucine a empoisonné son chat.

22. Quentin a berné le gardien.
23. Les filles vont recommander ce restaurant.
24. Capucine a examiné le document.
25. Quentin va manquer le train.
26. Les garçons ont mené le chien chez le vétérinaire.
27. Capucine doit chercher un livre.
28. Les garçons ont interrogé le voisin.
29. Quentin a ingurgité le dessert.
30. Capucine doit analyser le problème.
31. Les garçons doivent laisser un pourboire.
32. Quentin a accumulé de l'argent.
33. Capucine doit intéresser le public.
34. Quentin a réalisé un rêve.
35. Les garçons ont haché l'ail.
36. Les filles vont imaginer un scénario.
37. Les garçons doivent utiliser l'aspirateur.
38. Les filles ont vexé le professeur.
39. Capucine doit chronométrer son frère.
40. Les filles vont sculpter le bois.
41. Les garçons ont facilité le travail du professeur.
42. Quentin va illuminer le sapin.
43. Les filles ont découragé le surveillant.
44. Capucine doit teinter le foulard.

45. Quentin va céder son tour.
46. Les filles ont organisé un tournoi.
47. Quentin va recommencer le numéro.
48. Les garçons doivent encourager le coureur.