

NOTE

When memorized instances compete with rules: The case of number–noun agreement in written French*

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ABSTRACT

It is claimed by Totereau, Thévenin & Fayol (1997) that French children understand the rule for spelling the plural inflection very early on. However, no evidence contradicts the alternative that they learn the spelling of a word's singular and plural forms by treating the two forms as entirely different words. We tested this by asking French first and second graders (85 six-year-old and 89 seven-year-old children, respectively) to read and write rare words, either in just the singular or in just the plural, and then testing their spelling. The children tended to attach plural inflections to words which they had encountered only as plural and to omit them from words encountered before only as singular.

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INTRODUCTION

Children learn to read and write partly by acquiring rules (e.g. phoneme–grapheme correspondence) and partly by remembering highly specific written forms (Share, 1995). Most children master grapheme–phoneme correspondence rules quite early on (at 5;0–6;0). At the same time they learn the spellings of many specific words, particularly ones that they encounter quite frequently as whole words. This word-specific, non-rule-like learning allows them to form a lexicon of words that are frequent, but often hard to spell on the basis of simple letter–sound rules (e.g. *school*, *women*).

Knowledge of grapheme–phoneme relations should allow young English-speaking children to distinguish singular and plural forms of the same word, since in English these have different sounds. They could spell the plural form on the basis of the sound added to the singular form in speech (*cat*, *cats*). In French, however, the plural ending is silent. It is represented in writing but not pronounced in speech (e.g. *chat*, *chats*). French children find the singular–plural distinction in written nouns, adjectives and verbs extremely difficult (Fayol, Thévenin, Jarousse & Totereau, 1999). Initially, following grapheme–phoneme rules, they tend to omit the silent plural ending and thus they make more spelling mistakes with plural than with singular words.

It follows that French children need to know more than grapheme–phoneme associations to learn the different spellings for singular and plural forms, and to a certain extent this might be true of English children too. In English the sound of the plural ending is often /z/ (e.g. *dogs*), although it is always spelled as *-s*. Beers & Beers (1992) and Read (1986) both reported that English-speaking children rarely spell such words with a *-z* ending, and claimed that therefore they use the morphologically based rule that the spelling for the plural suffix is *-s*. However, this morphological explanation now seems implausible. Many English-speaking children and adults show no knowledge of the rule about the *-s* spelling for plural pseudo-words ending in the /z/ sound (Kemp & Bryant, 2003).

Another possibility is that French and perhaps English children too initially learn to spell singular and plural forms on the basis of word-specific knowledge, which is heavily dependent on the frequency with which they encounter particular written words. In that case French children, who have no sound cue to help them distinguish singular from plural, should make mistakes in spelling words that they encounter much more in one form (singular/plural) than in the other. They should omit plural endings when spelling the plural form of words that they encounter most frequently as singular, and should wrongly add the plural ending to the singular form of words that they usually see written as plural. Both mistakes have been recorded in abundance in French children learning to spell (Fayol *et al.*, 1999). However, since it is hard to control or measure the experience that individual

children have with singular and plural forms of particular words, it has not been possible to test the hypothesis about frequency (Cousin, Largy & Fayol, 2002).

To test this hypothesis we used unfamiliar words and varied the frequency with which children see them written as singular or plural. We gave children a series of unfamiliar but easily imageable nouns to read and to spell. Half the nouns were presented in the singular and half in the plural only. Half of each of these nouns was presented frequently and half infrequently. Twice in the year children were tested for their ability to write all these nouns, both as singular and as plural. We made four predictions.

Firstly, as in previous studies, children will make more mistakes with plural than with singular words because their knowledge of grapheme–phoneme correspondences will make them reluctant to represent the silent plural.

Secondly, however, children should also find it relatively hard to spell singular nouns when they have experienced them only as plural, and relatively easy to spell as singular those nouns encountered in the singular. We call this predicted effect the CONGRUENCY EFFECT.

Thirdly, this Congruency effect should be sensitive to frequency. The more often the children encounter nouns as plurals (vs. singular), the more errors they will make when spelling them in the singular (vs. plural) form and the fewer errors they will make when spelling them in the plural (vs. singular) form. We call this predicted effect the FREQUENCY EFFECT.

Fourthly, in France, first graders do not receive any direct instruction about noun–number agreement. In contrast, second graders are directly taught the rule of agreement and are drilled to apply this rule. We therefore expected better performance in second- than in first-grade children.

EXPERIMENT

METHOD

Participants

Eighty-five first graders (mean age 6;2) and 89 second graders (mean age 7;3), all French native speakers, participated.

Material

Forty animal, plant or object nouns that were easy to illustrate made up a set of cards, each containing a written word and a corresponding picture.

All 40 items are real, though highly infrequent nouns. None are in any of the reading instruction texts that the schools use. None feature in the Novlex list (Lambert & Chesnet, 2001). All are absent from, or have a very low frequency in, the Brulex list (Content, Mousty & Radeau, 1990).

The 40 nouns were divided into four lists of 10 nouns (L₁, L₂, L₃, L₄), matched in terms of the length of the words and the regularity of their phoneme-grapheme transcription (according to the Novlex database). Each list of 10 nouns was presented under one of four different conditions as a function of frequency of incidence (high vs. low) and number (singular vs. plural) (HS: High rate of incidence Singular; HP: High rate of incidence Plural; LS: Low rate of incidence Singular; LP: Low rate of incidence Plural) (see Appendix 1).

Procedure

The study took place over one year. In December, the participants were first given a pretest in which they were asked to write all of the 40 nouns. This pretest established that the scores of the children coming from the same school level but from different classes did not differ significantly from one another.

Later the children took part in two training phases, each of which lasted ten weeks. They were tested again immediately after each training phase, in March and in June.

Training phase. The 40 nouns were presented in the four different conditions (HS, HP, LS, LP): every child was given 10 words in each condition. We presented half of these words in the plural, and half in the singular. Half were presented frequently (i.e. 20 times in each phase – 10 by reading and 10 by copying them down), half rarely (i.e. twice in each phase – 1 by reading and 1 by copying them down). Each word was preceded by the indefinite article and presented together with an illustration (a single entity for the singular words or two to three of these for plural words).

The frequently presented items (High level of incidence) were the subject of a group reading lesson that took place once every two weeks over the 10-week period. The teacher showed the children the written words, with their illustrations, and read each word out and then asked the children to copy them. The rarely experienced items (Low level of incidence) were given to the children in the same way, but once only in the same 10-week period. All the children encountered each word, but in only one of the four conditions. At the end of 10 weeks of training the children had therefore read and copied each of the 20 frequently presented words 10 times and each of the rarely presented words once.

Test phase. This phase consisted of a dictation test. Each noun was embedded into a simple sentence (e.g. singular *Il voit un ...* 'He sees a ...' vs. plural *Il voit des ...* 'He sees ...'). The children had to write the nouns into specially prepared booklets with one sentence per page. The children were asked to write in the noun which was missing from dictated sentence. The order of the 40 sentences was randomized.

The children in each class were divided into two groups: the nouns dictated as singular for one group were dictated as plural for the other group, and vice versa. Each list of 10 nouns was split into two sublists, matched on the basis of word length and consistency. Each sublist contained just singular or just plural nouns.

RESULTS

We took out of our analysis children who were absent either during a part of the training phase (23 in the first training phase; 16 in the second training phase) or for the test phase (4 in March; 6 in June). Moreover, 7 participants (5 first and 2 second graders) did not write anything during the first test phase. Our analysis, therefore, included only 56 first and 84 second graders in March and 67 first and 85 second graders in June.

Table 1 presents the error scores. The study produced four main results. Firstly, the children had far more difficulty in writing plural than singular nouns (Totereau *et al.*, 1997). Second as well as first graders were much more likely to omit the plural ending when it was needed than to place it incorrectly at the end of a singular noun.

Secondly, the scores in Table 1 supported our second prediction. The children did better at spelling singular (vs. plural) nouns when these had been presented to them only as singular (vs. plural) in the training phase than when they had been presented as plural (vs. singular) nouns. This result demonstrates the existence of the predicted Congruency effect.

Thirdly, Table 1 supports our third prediction. The Congruency effect was sensitive to frequency. The effect was observed only with frequently presented nouns.

Fourthly, the Congruency effect was also slightly sensitive to school-level differences. It was more marked among the younger children, but the pattern of errors was the same, which suggests that first and second graders behave only partly differently.

We carried out a 2 (School level: first and second grades) \times 2 (Sessions: March, June) \times 2 (Task: Write in the singular or in the plural) \times 2 (Rate of incidence of items: high versus low) \times 2 (Number: items presented in the singular versus the plural) ANOVA on the proportion of agreement errors (adding a plural suffix to a singular word or omitting the suffix on a plural word) with repeated measures on the last three factors. Because the effects observed with participants as random factor were systematically present with items as random factor, we only report participants' analyses.

The analysis did produce a significant Task effect: French-speaking children found singular nouns much easier to spell (4.8% errors) than plural ones (63% errors) ($F(1, 288) = 773.69$, $MSE = 0.25$, $p < 0.001$). There was also

TABLE I. Mean percentages (S.D.) of agreement errors as a function of grades, tasks, and characteristics of items

FIRST GRADERS		Task: WRITE IN THE SINGULAR			
Presented items	Singular frequent	Plural frequent	Singular rare	Plural rare	
March (N = 56)	6.7 (14.6)	11.0 (23.1)	4.8 (17.5)	4.9 (16.6)	
June (N = 67)	4.7 (15.8)	9.6 (19.9)	4.7 (15.9)	4.9 (14.5)	
		Task: WRITE IN THE PLURAL			
Presented items	Singular frequent	Plural frequent	Singular rare	Plural rare	
March (N = 56)	84.0 (27.6)	68.9 (36.7)	76.5 (31.5)	76.4 (35.0)	
June (N = 67)	79.0 (36.3)	62.5 (36.4)	75.4 (33.3)	74.8 (35.7)	
SECOND GRADERS		Task: WRITE IN THE SINGULAR			
Presented items	Singular frequent	Plural frequent	Singular rare	Plural rare	
March (N = 84)	2.2 (8.4)	7.6 (13.2)	4.8 (18)	3.4 (16.6)	
June (N = 85)	0.9 (6.1)	7.4 (12.2)	0.3 (2.7)	2.2 (14.5)	
		Task: WRITE IN THE PLURAL			
Presented items	Singular frequent	Plural frequent	Singular rare	Plural rare	
March (N = 84)	56.0 (36.6)	42.1 (37.1)	56.5 (29.7)	53.4 (31.3)	
June (N = 85)	56.4 (35.0)	44.0 (38.5)	58.8 (35.2)	56.3 (36.1)	

a significant School level effect: second graders made fewer mistakes than first graders ($F(1, 288) = 36.07$, $MSE = 0.20$, $p < 0.001$). Both of these results were qualified by a significant Task \times School level interaction ($F(1, 288) = 18.48$, $MSE = 0.25$, $p < 0.001$). As expected, second graders made fewer mistakes (28.3%) than first graders (39.8%), but the decrease was far more important with plurals (-20%) than with singulars (-2.4%). The Session effect was not significant and interacted only with Frequency ($F(1, 288) = 4.89$, $MSE = 0.02$, $p = 0.05$): the frequently encountered nouns gave rise to

fewer errors in June than in March (-3.4%) while no such effect occurred with rarely encountered nouns. However, the effect was small and had no impact on the global pattern of errors.

Frequently encountered nouns gave rise to fewer errors (33.15%) than rarely encountered nouns (34.88%) ($F(1, 288) = 6.76$, $MSE = 0.02$, $p = 0.01$). Nouns presented in the singular form induced slightly more errors (35.12%) than those presented in the plural form (32.92%) ($F(1, 288) = 15.32$, $MSE = 0.017$, $p = 0.002$). These effects were small and did not modify the global pattern of errors.

The Congruency effect and its sensitivity to frequency were attested by several interactions. The Rate of incidence \times Number ($F(1, 288) = 6.48$, $MSE = 0.02$, $p = 0.02$) showed that only the frequently encountered nouns were sensitive to their number (singular vs. plural) in the training phase. Children made more mistakes with frequently encountered nouns in the singular form than with frequently encountered nouns in the plural form (35.02% and 31.29% respectively), while rarely encountered nouns induced an equal number of mistakes (35.22% and 34.55% respectively). The Rate of incidence \times Task interaction ($F(1, 288) = 32.22$, $MSE = 0.026$, $p < 0.001$) showed that errors produced in writing in the singular as well as in the plural varied as a function of the rate of incidence. Children made more mistakes in the singular and fewer mistakes in the plural with frequently encountered nouns than with rarely encountered nouns (Task singular: 5.9% vs. 3.75% respectively; Task plural: 60.38% vs. 66.02% respectively). The Number \times Task interaction ($F(1, 288) = 53.02$, $MSE = 0.022$, $p < 0.001$) showed that writing in the singular was more difficult when the noun had been encountered in the plural (6% errors) than in the singular (4% errors), and conversely that writing in the plural was easier when the noun had been encountered in the plural (60% errors) rather than in the singular (67% errors). However, the most important result is the Rate of incidence \times Number \times Task interaction ($F(1, 288) = 34.86$, $MSE = 0.022$, $p < 0.001$) (see Figure 1).

The Number \times Task interaction is significant with frequently encountered items ($F(1, 288) = 67.38$, $MSE = 0.028$, $p < 0.001$), but not with rarely encountered items ($F(1, 288) = 1.44$, $p = 0.23$, *ns*). The nouns frequently encountered in the plural were more difficult to inflect in the singular (8% errors) than those frequently or rarely encountered in the singular (4% errors each); the nouns frequently encountered in the plural gave rise to fewer errors (54% errors) when they had to be inflected in the plural than those frequently or rarely encountered in the singular (66% and 67% errors respectively). This three-way interaction did not interact with School level or Session, which suggests that the pattern of errors was the same with first and second graders in March as well as in June. Planned comparisons confirmed that the Congruency \times Frequency interaction was significant and that it

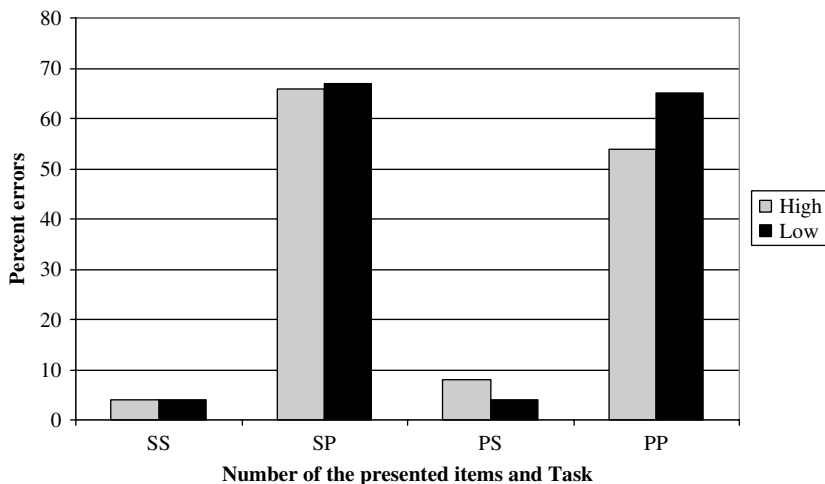


Fig. 1. Percentages of errors as a function of Number (Singular vs. Plural, noted as the first S or P) of the presented items, Rate of incidence (High vs. Low), and Task (write in the Singular vs. in the Plural, noted as the second S or P).

extracted more than 50% of the experimental variance at each session and at each grade.

DISCUSSION

To our knowledge, it has never as yet been claimed that children may base their spelling of inflected words on remembering them as whole words without decomposing them, i.e. as monomorphemic and not as bimorphemic words. However, Sterling (1983) suggested that the direct retrieval of the complete item was possible and Carlisle (1987) reported such a possibility in learning-disabled adolescents using tasks tapping derivational morphology. One might reasonably expect that young, and especially French, children might experience some inflected or derived words more often than their stems (words like 'parents' or 'shoppers'), and consequently store them as whole words in the orthographic lexicon.

Our experiment clearly showed that this kind of memorization of inflected instances as whole words does occur, at least in the case of French nouns bearing a silent *-s* inflection. The evidence for this is the Congruency effect, which facilitates the correct spelling of nouns that children have frequently encountered in the required inflected form (singular or plural), and impairs the spelling of those that children have frequently encountered with the inflection (singular or plural) that is complementary to the one they are asked to produce. The Congruency effect may indicate that children of this age

never decompose inflected words into stem and affix. Alternatively, it could be argued that our experimental procedure, which involved presenting each word in one form only, might have engendered a kind of priming effect which led to the children repeating the form that they had seen. However, our previous research (Fayol *et al.*, 1999) makes this alternative most unlikely because it clearly establishes that French children spontaneously write singulars as plurals and vice versa without any preliminary intervention by the experimenters.

The Congruency effect is interesting for three reasons. First, it is consistent with previous evidence that adults and children sometimes erroneously retrieve regularly inflected words instead of using an agreement rule (Largy, Fayol & Lemaire, 1996). Under standard writing conditions, most educated adults inflect nouns and verbs correctly, regardless of whether or not they have homophones. Yet substitution errors on items with homophones (e.g. *timbres* 'stamps' as a plural noun vs. *timbrent* 'they stamp' as a plural verb) may arise when adults focus more on the meaning of their message than on its orthographic correctness. This phenomenon has been demonstrated experimentally. When French university students have to write sentences in a single task condition, they almost never use *-s* in place of the plural marker *-nt*. However, when they have to write the same sentences in a dual task condition, they sometimes make substitution errors on verbs that can be nouns. These errors are especially frequent with noun/verb homophone pairs in which the noun is more frequent than the verb (e.g. Largy *et al.*, 1996). This result suggests that spellers sometimes rely on a retrieval procedure rather than the application of a rule which would lead to the correct verb agreement. The same phenomenon has been reported in primary school children (Totreau, Barrouillet & Fayol, 1998). These data are compatible with the weak form of Prasada & Pinker's (1993) dual-model generalized to the acquisition of literacy. Morphologically complex words could thus be accessed or produced either through a whole-word representation or via a (de)compositional route. These two routes are in competition with one another, and word frequency determines which route wins. There could be whole-word representations for frequent regularly inflected forms. Indeed, New, Brysbaert, Segui, Ferrand & Rastle (2004) have provided evidence that whole-word frequency effects can be reliably obtained for regularly inflected French nouns provided that they are high in frequency. However, such dual-mechanism models find it difficult to deal with the development of morphology. For example, these authors consider that, in French, plural nouns are derived from a base (e.g. the singular form) through the application of a morphological rule (e.g. add an *-s* at the end of the noun). They do not explain how children learn what are the bases and what are the inflections. Young children are, from the outset, able to use several strategies to spell words: they can refer to phoneme-grapheme correspondences, make

use of graphotactic regularities (Pacton, Fayol & Perruchet, 2005), use analogies to known lexical items (Martinet, Valdois & Fayol, 2004) and, as has been shown here, retrieve whole words already inflected directly from memory. Most of the time these strategies lead to success, but sometimes they fail, especially when a conflict arises between them (see Graves & Koziol, 1971, for a related phenomenon in English). This happens when nouns that are frequently inflected in the plural have to be put in the singular. It should be noted that errors are less frequent, but still significant, when words repeatedly encountered in the singular have to be made to agree in the plural. This is probably due to the singular being the default state in written French (Eberhard, 1999).

The second reason is that our results show that children can memorize inflected, as well as uninflected, words from the very beginning of learning to read and spell. Data obtained by Reitsma (1983), Share (1995, 1999) and Martinet *et al.* (2004) provide evidence that, once the basic mechanisms of the oral-written correspondence are established, the learning of whole words occurs. In the case of some words, children encounter the bases first (e.g. *la lune* 'the moon') and their inflected forms later, whereas with other words, such as 'parents', the opposite occurs (Cousin *et al.*, 2002). As a consequence, they build up a lexicon made of whole-words in which a global form appears to be directly associated with a meaning and a syntactic context without morphological (de)composition, since the children are unaware that -s marks the plural. The learning of the whole-word forms is frequency dependent: the more often a form is encountered, the more likely it is that it will be memorized, and the more probable it is that it will be retrieved directly from memory. At the same time, as their lexicon expands, children may extract regularities from this lexicon which eventually lead to the emergence of inflections and bases, as connectionist models claim (Seidenberg & Gonnerman, 2000). This extraction is relatively easy in written French because almost all nouns take -s to form their plural. In fact, the noun plural is marked by -s in more than 99% of cases, with only 600 words out of 36 000 ending in -s in the singular form (e.g. *une souris* 'a mouse') and therefore requiring no -s when pluralized, and about 50 other words forming their plural using another kind of inflection (e.g. adding -x instead of -s to *chou* 'cabbage'). The regular noun plural inflection is thus highly regular and systematic, applies to thousands of nouns and is productively generalized to neologisms (and pseudo-words), even by second graders (Totereau *et al.*, 1998). Memorizing instances enables children both to use whole words (sometimes erroneously) through direct retrieval of the inflected forms when so required and to extract orthographic (morphological) regularities. Longitudinal studies should make it possible to show whether this conception is more compatible with the evolution of French written morphology than the classical dual-route model.

The third reason is that no difference in the spelling error patterns was observed in first and second graders. In France, no systematic instruction is provided during first grade, whereas second graders are explicitly taught to apply the agreement rule. Despite this difference, and despite the general decrease in errors between those two school levels, the error pattern remained the same. This result is consistent with previous data collected on adult's and older children's performances. Fayol, Largy & Lemaire (1994) and Largy *et al.* (1996) showed that adults who knew the noun agreement rule and were able to apply it when explicitly required to do so nevertheless made agreement errors when their attention was distracted. The errors consisted in retrieving erroneous forms, generally those corresponding to the most frequent form. The same trends have been reported in fifth graders (Fayol, Hupet & Largy, 1999). These results suggest that most of the time children rely no more heavily on rules for spelling words than adults do. The explicit teaching of a morphological rule does not guarantee the use of this rule. A series of results have shown that the application of explicit rules is highly demanding, a fact which could explain the high frequency of omission errors concerning the *-s* plural inflection in young children and the occurrence of substitution errors in adults. However, children and adults do inflect many nouns correctly. Thus, we still need to find out how people perform noun agreement in real time, sometimes retrieving whole inflected words and sometimes using rules – at least when they know them – and how they coordinate these two processing modes, most probably together with others. Again, longitudinal studies could provide insights into the learning and use of these different strategies.

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MEMORIZED INSTANCES AND RULES

APPENDIX I

THE FOUR LISTS OF EXPERIMENTAL ITEMS

<i>L₁</i>		<i>L₃</i>	
<i>bonite</i>	'bonito'	<i>crotale</i>	'whip snake'
<i>dogue</i>	'mastiff'	<i>dorine</i>	'opposite-leaved golden saxifrage'
<i>silène</i>	'catch-fly'	<i>murène</i>	'moray'
<i>carabe</i>	'ground beetle'	<i>caroube</i>	'carob'
<i>cade</i>	'juniper'	<i>martre</i>	'marten'
<i>tourte</i>	'pie'	<i>lingue</i>	'ling'
<i>lompe</i>	'lumpfish'	<i>crave</i>	'white-winged chough'
<i>drave</i>	'rafting'	<i>nêfle</i>	'medlar'
<i>cupule</i>	'acorn cup'	<i>bâche</i>	'tarpaulin'
<i>prêle</i>	'horsetail'	<i>berle</i>	'water parsnip'
<i>L₂</i>		<i>L₄</i>	
<i>colobe</i>	'colobus'	<i>scarole</i>	'a kind of endive'
<i>dorade</i>	'snapper'	<i>loche</i>	'atlantic tomcod'
<i>fève</i>	'bean'	<i>brème</i>	'bream'
<i>termite</i>	'termite'	<i>jujube</i>	'jujube'
<i>figue</i>	'fig'	<i>dague</i>	'dirk'
<i>canche</i>	'lingonberry'	<i>bugle</i>	'flttgelhorn'
<i>câpre</i>	'caper'	<i>rave</i>	'roe'
<i>congre</i>	'conger'	<i>pintade</i>	'guinea fowl'
<i>sterne</i>	'tern'	<i>silure</i>	'catfish'
<i>carline</i>	'dwarf thistle'	<i>grèbe</i>	'grebe'