The Homophone Effect in Written French: The Case of Verb–Noun Inflection Errors

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The Homophone Effect in Written French: The Case of Verb–Noun Inflection Errors

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Sometimes people miswrite a word that sounds like the target word (e.g. “there” instead of “their”). This homophone effect is interesting in that it is one of the rare cases in which grammatical classes can be violated. In five experiments, we provided evidence that the homophone effect can be experimentally induced in French adults. This effect manifested itself through the occurrence of noun–verb inflection errors. These inflection errors were elicited by presenting subjects with “pronoun1 pronoun2 verb” sentences and asking them to recall these sentences by writing them down. In these sentences, when the verb had a noun homophone whose frequency was higher than that of the verb, the erroneous inflection was most often -s, the plural mark of nouns. The first three experiments showed that this homophone effect was enhanced when working memory was overloaded. The last two experiments showed that the homophone effect increased when the meaning of the noun was primed by a relevant semantic context. The present findings are interpreted in the framework of an activation model.

INTRODUCTION

This paper is concerned with understanding the mechanisms that underlie the production of homophone confusions in writing. Homophone confusions occur when subjects miswrite a word for another word that is phonologically similar (e.g. substituting “there” for “their”, “two” for “too”, or “seen” for “scene”). This effect has been reported in the spontaneous written language production of educated adults (Hotopf, 1980; 1983;
Morton, 1980) and poor spellers (Frith, 1980). Understanding how subjects are led to substitute a word for one of its homophones can shed light on more general mechanisms and linguistic representations used by our cognitive system to carry out sound-to-grapheme translations in written language production. For example, it would help us to understand how the linguistic production system outputs an orthographic form of a word (e.g. “scene”) which does not correspond to the intended meaning (e.g. “seen”), given the maintenance of the phonological similarity of both the output and target words. A fascinating case is when a target word (e.g. a verb) is miswritten as an erroneous word (e.g. a noun) from a different grammatical category (e.g. “stamps” instead of “stamp”). Unfortunately, the homophone confusion phenomenon occurs rarely in spontaneous written language production and is difficult to elicit in laboratory-controlled studies.

The three main aims of this study were: (1) to show that the verb–noun homophone effect can be experimentally elicited; (2) to test the effect of several variables that are critical in language processing (the relative frequency of the noun and verb forms, the extent to which the context favours a noun or a verb activation, and the demands of a secondary task subjects are asked to perform); and (3) to propose a simple preliminary mechanistic account of this homophone confusion phenomenon. We first review properties of the homophone confusion effect and then elaborate on the rationale behind our study.

The Homophone Confusion Effect

Properties of the Homophone Confusion Effect. The homophone confusion effect has been reported by a number of authors (Caramazza & Hillis, 1991; Hotopf, 1980; 1983; Morton, 1980). A common feature of the homophone confusion effect that emerged in these studies was that the effect is very rare in spontaneously written language production. Homophone substitutions are rare partly because a given language provides few opportunities for their occurrence (e.g. Carramazza & Hillis, 1991). Many languages like English have a number of noun–verb homophones, with many nouns also being used as verbs (e.g. “to stamp”, “a stamp”). However, many of these homophones are also homographs, and it is difficult to find homophones that are not also homographs (e.g. “seen” and “scene”). If we wish to study experimentally the homophone confusion effect in written spelling, it is necessary to select homophones that are not homographs. More generally, this suggests using a symbolic system with a silent morphology that would make such confusions more likely. Some languages (e.g. French or Greek) have this characteristic. In the present experiments, we used the French language and selected a set of target words that are homophones but not homographs.
Another potential reason for the rarity of homophone confusions in written language is that our cognitive system is rather good at detecting and correcting mistakes on-line, and such substitutions in particular, before actually producing them. Hotopf (1983) noted that written language allows subjects more opportunities to avoid mistakes compared with oral language. First, the slow rate of writing allows writers to bypass or to suppress some mistakes when the message is still in its phonological form or when it is on the point of being transcribed. Second, the remaining written trace may trigger a post-production checking process that edits these mistakes and makes their correction possible. However, these advantages of written language have a cognitive cost. As argued by Hotopf, the passage from an already (partially) produced message in its phonological form to its graphological form imposes great attentional demands. This attentional cost may be even higher when the written message includes graphemic cues with no corresponding oral cues, as is the case with most of the final -e/-es/-ent morphemic French inflections, which all correspond to the same ending phonemes of words. This analysis suggests that one way to enhance the spontaneous occurrence of homophone confusion errors is to increase experimentally subjects’ attentional demands while producing language. In the present experiments, we chose to increase the demands on working memory by using the dual-task technique and asked subjects to recall sentences while remembering sets of words.

Finally, in homophone substitutions, one word replaces another word. The phonological similarity is but one condition for such a substitution to show up. However, we are not clear whether these substitutions are symmetrical; that is, if it is as likely for word1 to be substituted for word2 as it is for word2 to be substituted for word1. Given unequal frequencies of each word, it is uncertain whether such a symmetry can be established empirically. In several areas of language processing, it has been shown that the frequency of occurrence of items is a critical variable (Burke, MacKay, Worthley, & Wade, 1991; Fay & Cutler, 1977; MacKay, 1979; Stemberger, 1984; 1985). This suggests that, to delineate precisely under what conditions phonological similarity is critical for the occurrence of homophone substitutions, the frequency of words has to be controlled or manipulated, exactly what we attempted in the present study.

The French Language as a Candidate for Investigating the Homophone Confusion Effect. Some languages involve a more or a less silent morphology; that is, the phonological representation of the words has no direct correspondence to the graphemic representation. One key process, then, is the matching between these two representations. The conditions under which this process leads to correct or incorrect spelling are not very clear. The homophone confusion effect is one effect that might shed light on
these conditions. Languages with a predominantly silent morphology might enhance the occurrence of this effect, since they offer more opportunities for the process to be disrupted due to the indirect correspondence between the phonological and graphemic representations of written words.

French is a language with a predominantly silent morphology. In French, the noun- and verb-forms of the same words frequently sound alike but are inflected quite differently in the written modality. For example, *le timbre/elle timbre/les timbres/elles timbres* {the stamp/she stamps/the stamps/they stamp, respectively} are all pronounced alike, apart from the articles or the pronouns preceding the nouns or verbs, but are spelled differently. Exceptions include those cases where there is a liaison phenomenon—that is, when the consonant that ends a word is pronounced together with the following word that begins with a vowel (Melecot, 1975). Apart from these exceptions, it was expected that a pronunciation/spelling mismatch would increase the number of homophone confusions involving nouns and verbs when using the French language to investigate the homophone confusion effect. Indeed, when English subjects have to write “stamp” (e.g. “the stamp”) or “stamps” (e.g. “she stamps”), they have a phonological cue (i.e. /s/) to guide their spelling, whereas French subjects have no such cue. In fact, this pronunciation/spelling mismatch effect has already been observed to increase errors in research in which French adults were asked to recall orally presented sentences by writing them down (Fayol & Got, 1991; Fayol, Largy, & Lemaire, 1994). As the subjects were writing *elle les timbre* (literally, “she them stamps”), they wrote *timbres* (stamps as in “the stamps”) instead of the correct *timbre* (stamp as in “she stamps”). That is, they seemed to agree the verb as if it were a noun.

Another feature of the French language that makes it an interesting candidate to investigate the homophone confusion effect is the relative frequency of the noun and verb forms of homophones. That is, some noun–verb homophones are more often nouns (vs verbs) than the reverse in the French language. This characteristic allows us to test the hypothesis that the relative frequencies of the noun and verb forms influence word inflections, so that the homophone confusion effect would occur more or less frequently according to the relative dominance of one grammatical category over the other.

**The Present Study**

In the experiments reported here, we tested homophone confusion errors in a sentence writing task. Native speakers of French were presented with orally dictated sentences, some of which included a verb with a noun homophone. Half of the verbs having a noun homophone involved a noun homophone that had a higher frequency than its verbal counterpart; the
reverse was true for the other half. Following Fayol et al. (1994, experiment 3), these verbs were inserted into specific syntactic configurations, consisting of “pronoun1 pronoun2 verb” sequences. This syntactic context was selected because it was expected to favour the homophone confusion effect in written French. Indeed, the nominal plurality is mainly, and almost exclusively, conveyed by the articles (un/une/des vs le/la/les {a vs the}) that carry the critical information about number and gender in oral French (Dubois, 1965). The “article + noun” configuration is very frequent and highly relevant to number marking. In the experiments reported here, the to-be-agreed verbs occurred after a direct-object pronoun (le/la/les [him/her/them]) that had the same phonological and graphemic form as the definite article. As a consequence, the “pronoun2 + verb” sequence helped to induce the homophone error effect, given its similarity with the “article + noun” sequence.

In order to test the effect of the relative frequency of the noun and verb forms, we manipulated noun–verb confusability. That is, some verbs could not be confused with a noun because they have no noun homophone (e.g. trouver {to find}), whereas others could be confused with a noun because they do have a noun homophone (e.g. timbrer {to stamp}). The frequency of some of these confusable verbs was greater in the verb-form than in the noun-form (e.g. timbrer {to stamp} has a higher frequency than timbre {stamp}), whereas the opposite is true for other confusable verbs (e.g. forme {shape} has a higher frequency than former {to shape}). When a verb has no corresponding noun homophone, the verb is expected to activate only verbal graphemic inflections. When a verb has a corresponding noun homophone that is more frequent as a verb than as a noun, verb graphemic inflections are predicted to be more strongly activated than those of the noun, leading to rare homophone inflection errors. Finally, when a verb has a noun homophone which is more frequent as a noun than as a verb, the noun graphemic inflection is expected to be strongly activated and to interfere with the verb graphemic inflection, eliciting homophone confusion errors. Experiment 1 and Control Experiments 1A and 1B tested these predictions.

In Experiments 2A and 2B, the context of the sentence (i.e. the semantic content preceding the target sentence) was manipulated in order to determine whether the context would favour a noun or a verb activation. This context was manipulated by increasing or decreasing the associative relatedness between the target verb and some of the other words of the previous part of the sentence. When the context was favouring the noun homophone, a noun graphemic inflection was expected, whereas a verb graphemic inflection was expected when the context favoured the verb homophone.

Our experimental manipulations had to control for a known source of agreement errors that might be confounded with the homophone confusion
effect investigated here. This well-established phenomenon has been termed the attraction effect or *proximity concord error*. In sentences of the “pronoun1 pronoun2 verb” type, subjects are more likely to make the verb agree with pronoun2 than with pronoun1, simply because of the proximity or attraction between pronoun2 and the verb (Bock & Cutting, 1992; Bock & Eberhard, 1993; Bock & Miller, 1991; Fayol et al., 1994; Francis, 1986). In French, for example, *elle les timbrent* (literally, “she them stamp”) is a proximity concord error, because the verb agrees with the closest pronoun (*les* instead of the subject pronoun *elle*). By contrast, *elle les timbres* is a homophone confusion, because the verb is made to agree like a plural noun. This paper focuses only on these homophone errors.

In order to increase the probability of homophone confusions, we used the secondary task paradigm in the five experiments reported here. We asked some of the subjects to recall series of phonologically confusable words or nonwords after writing the target sentences down. They had to maintain these words in working memory while transcribing the sentences. This manipulation relied on the common assumption underlying the dual-task paradigm, that the computational and storage components of working memory compete for a common pool of limited cognitive resources (Baddeley, 1986; Carpenter, Miyake, & Just, 1994; Gathercole & Baddeley, 1993; Miyake, Just, & Carpenter, 1994). Specifically, we assumed that the pool of working-memory resources that may be devoted to a written language production task is limited, and that competition for working-memory resources from a secondary task will degrade performance to the extent that (1) the primary task requires working-memory resources to be completed, (2) the total amount of working-memory resources is limited, and (3) the two tasks require more resources than are available within the working-memory system. As a consequence, in the present experimental context, the increase in homophone inflection errors was expected to be enhanced by a greater storage load condition (i.e. in which subjects had to memorise lists of words or nonwords). Indeed, the processing component was expected to be negatively affected, making more difficult the resolution of graphemic inflections (Power, 1985; 1986). Following the logic of the dual-task paradigm, performance on the secondary task was used as an additional index of the working-memory resources consumed by the primary task. Therefore, we expected that the more difficult the inflection, the smaller the number of words (or nonwords) recalled. Thus, the secondary task manipulation was expected to offer us the possibility to disrupt noun–verb ambiguity resolution and to assess the relative difficulty of this resolution.

To summarise, we wished to show that it is possible to elicit the homophone effect experimentally by inducing graphemic inflection errors that consist of using a noun inflection when a verb inflection is required. The frequency of this substitution in “pronoun1 pronoun2 verb” sequences was
expected to increase as a function of the memory demand, the relative frequency of noun–verb homophones, and the contextual bias introduced by a preceding clause.

**EXPERIMENT 1**

Experiment 1 aimed to show that it is possible to elicit the homophone effect experimentally. To do this, we composed sentences comprising noun–verb homophones, the relative frequencies of which were controlled. These sentences were presented orally to adults who had to recall them by writing them down while undertaking a secondary task.

**Method**

**Subjects**

Sixty undergraduate students (34 females, 26 males) at the University of the Bourgogne, Dijon, France, with a mean age of 18.7 years:months (range 17.9–20.9 years:months) volunteered to take part in the study.

**Stimuli**

The stimuli comprised both sentences and words.

**Sentences.** Twenty-four sequences of two sentences each (a beginning sentence followed by a target sentence) were composed according to the following scheme (see examples in Appendices 1 and 2 for Experiment 1 and Control Experiments 1A and 1B):

1. Beginning sentence: article + noun1 + verb1 + article2 + noun2 (7 syllables); e.g. *Le chimiste prend des liquides* (The chemist takes some liquids).
2. Target sentence: pronoun1 (subject of verb2) + pronoun2 (direct object of verb2) + verb2 (4 syllables); e.g. *Il les filtre* (He filters them).

Each sequence therefore consisted of 11 syllables and the agreement problem concerned the verb of the target sentence. Three different target sentences were used as a function of the number of the pronouns: *Ils les* {plural/plural or PP; They them}; *Il les* {singular/plural or SP; He them}; *Ils le* {plural/singular or PS; They it/him}. The singular/singular combination *Il le* {He it/him} was not used here because whatever the agreement rule used (noun- vs verb-agreement), the same inflection would have occurred (i.e. -e).

The target sentences were composed according to the following scheme:
1. The first pronoun (il/ils {he/they}) was the subject of the verb.
2. The second pronoun (le/les {it vs him/them}) was the direct object of the verb. However, le/les in French can also act as articles and occur just before nouns, as in le chien {the dog} and les chiens {the dogs}. Therefore, at least in some cases, le/les are ambiguous, being either pronouns (before verbs) or articles (before nouns).
3. The verb was always a regular verb for which there were no audible differences between: (a) the singular and plural form of the verb (e.g. il pousse/ils poussent {it grows/they grow} sound alike) and (b) the singular and plural form of the corresponding noun, if any (e.g. la/les pousse(s) {the growth(s)}. These verbs belonged to one of three different categories: (1) the verb (n=12) could not be confused with a noun (i.e. it had no noun homophone counterpart; e.g. trouver {to find}); (2) the verb (n=12) could be confused with a corresponding noun homophone (e.g. il/ils timbre(nt); le/les timbre(s) {he/they stamp(s); the stamp(s)}). The verbs having a corresponding noun homophone were subcategorised into two groups of six verbs each according to the relative frequencies of the verb–noun homophones (Trésor de la Langue Française, 1971). In the first subgroup, the frequencies with which the verbs occurred were at least twice as high as the frequencies of the corresponding nouns (e.g. in French, juger {to judge} has a frequency of 13,579, whereas juge {the judge} has a frequency of 6079); these verbs were considered to form a “verb-dominant” category. In the second subgroup, the frequencies with which the verbs occurred were at least half the frequencies of the corresponding nouns (e.g. former {to shape} has a frequency of 14,741, whereas la forme {the shape} has a frequency of 39,569); these verbs were considered to form a “noun-dominant” category. Thus, there were three verb–noun relationships: verbs without any noun homophone; verbs more frequent than their noun counterparts; verbs less frequent than their noun counterparts. We shall refer to these three variants as V ≠ N, V > N and V < N, respectively, where V refers to the verb, N refers to the noun, and the signs ≠, > and < indicate the type of relation between V and N. In the first case, V ≠ N means that the verb has no noun homophone. The frequencies of noun and verb homophones are presented in Table 1.

To avoid the participants detecting the structure of the experimental sequences, 12 filler sentences were included. These fillers did not raise any agreement problem because they each comprised only one pronoun (e.g. Le sportif est arrivé. Il transpire {The athlete has arrived. He sweats}) or no pronoun at all (e.g. Les vacances sont terminées. C’est trop triste {The vacation is over. It’s too bad}).

Words. The same sentences were presented in either an isolated version or with series of three or five words to recall. For the “sentences + words” conditions, 36 lists of three words and 36 lists of five words were drawn up. The five-word lists were obtained by adding two more words to the
# TABLE 1
Homophonous Noun and Verb Frequencies: Experiment 1

<table>
<thead>
<tr>
<th>Relative Frequency</th>
<th>Verb</th>
<th>Noun</th>
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<tbody>
<tr>
<td>N &gt; V</td>
<td>coder</td>
<td>code</td>
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<tr>
<td></td>
<td>(12)</td>
<td>(774)</td>
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<td></td>
<td>former</td>
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<td></td>
<td>(14,741)</td>
<td>(39,569)</td>
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<td>gommer</td>
<td>gomme</td>
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<td>(12)</td>
<td>(314)</td>
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<td>griffer</td>
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<td></td>
<td>(221)</td>
<td>(1016)</td>
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<td>meubler</td>
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<td></td>
<td>(336)</td>
<td>(4394)</td>
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<td>timbrer</td>
<td>timbre</td>
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<td></td>
<td>(34)</td>
<td>(2203)</td>
</tr>
<tr>
<td>V &gt; N</td>
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<td>ferme</td>
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<td></td>
<td>(9636)</td>
<td>(3475)</td>
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<td></td>
<td>filtre</td>
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<td></td>
<td>(680)</td>
<td>(148)</td>
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<td></td>
<td>(2212)</td>
<td>(268)</td>
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<td>garder</td>
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<td></td>
<td>(21,488)</td>
<td>(11,290)</td>
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<td></td>
<td>juger</td>
<td>juge</td>
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<td></td>
<td>(13,579)</td>
<td>(6079)</td>
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<td></td>
<td>montrer</td>
<td>montre</td>
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<tr>
<td></td>
<td>(30,839)</td>
<td>(2773)</td>
</tr>
</tbody>
</table>
three-word lists. Each list respected the following constraints: (1) all the words were monosyllabic; (2) to control for regrouping strategies, all the words of a given three- or five-word series belonged to different semantic categories; (3) all the words were phonologically similar in order to increase the attentional load in the working-memory system (Baddeley, 1966; 1986; Conrad, 1964): *pois* {pea}, *loi* {law}, *noix* {nut}, *soie* {silk}, *toit* {roof}, for example (i.e. /pwa/lwa/nwa/swa/twa/ for their respective pronunciations).

**Recall Booklets.** To prevent the subjects from revising and/or correcting what they had recorded, they were each given a recall booklet and asked to turn the page as soon as they had written down either a sentence or a word list. The booklets consisted of 40 pages for the “sentences alone” group (4 pages for the training sentences and 36 pages for the sentences) and 80 pages for the two “sentences + words” groups (8 pages for the training, 36 pages for the sentences, and 36 pages for the three- or five-word lists).

**Control of Spelling Ability.** To probe the subjects’ spelling abilities, the 24 experimental sentences were later presented to the participants without their verb endings (e.g. *Il les timbr*... {He them stamp...}). These sentences were randomly presented on a sheet and the subjects were asked to make the correct agreement.

**Procedure**

The 60 subjects were divided at random into three groups of 20 subjects each. The first group received only the sentences. The second and third groups received the sentences followed by series of three or five words, respectively. For each group, the sentences were presented randomly, except that two experimental sentences never followed each other. In order to control for a possible order effect, each group of participants was further divided into two subgroups, each of which received the sentences in a different order.

The sentences (and words if any) were tape-recorded before the experimental session. The subjects were given the following instructions (the instructions referring to the two “sentences + words” conditions are given in parentheses):

The purpose of this experiment is to study the memorisation of sentences (and unrelated words). You are asked to listen to 40 sentences (each followed by a series of 3/5 words). [An example was given here.] Immediately after each sentence (vs after the third/fifth word), you are asked to write down the sentence (and the words) in the booklet that you have in front of you. On Page 1 you have to write the first sentence (and the series of words on Page 1a), on Page 2 the second sentence (and the words on Page 2a), and so on.
Immediately after the recall task, the subjects were given the spelling-ability task. They were given the sheet with the 24 experimental sentences and were explicitly asked to fill in the blanks with the relevant inflections.

**Results and Discussion**

All the subjects achieved a maximum score (100%) for correct agreement in the explicit agreement task they were presented with at the end of the experimental session. As a consequence, no mistakes could be attributed to a lack of knowledge of the agreement rule. In the recall task (with or without words), almost all sentences were correctly recalled. Only 63 of 1440 were discarded (4.3%) due to erroneous recall or to pronoun modifications (e.g. *il* (he) recalled instead of *ils* (they)).

We found three types of verbal agreement errors: (1) *-e* errors, occurring in 5.25% of PS sentences; (2) *-nt* errors, observed in 2.34% of SP sentences. These two types of errors arise from a well-known phenomenon, the *proximity concord effect* (Fayol et al., 1994), and are not relevant to the present study. (3) *-s* errors (12.08 and 5.97% in SP and PP sentences, respectively), which consist of inflecting the verb as though it were a noun. Given our interest in homophone confusions, only the analyses of these *-s* errors are reported here. Our dependent variable was *-s* error proportions, defined as the number of *-s* verb inflection errors divided by the number of correctly recalled sentences, multiplied by 100.

**-s Error Analysis.** As there were no *-s* errors in PS sentences, the ANOVA was conducted using a 3 (load) × 2 (sentence type: SP vs PP) × 3 (noun–verb confusability) design involving repeated measures on the last two factors. As can be seen in Table 2, the load effect was significant. Planned comparisons revealed that the error proportion was much lower under no-load (2.29%) than under load conditions (11.25 and 13.54% for the three- and five-word loads, respectively) \(F(1,57) = 12.19, P < 0.01, \text{MSe} = 670.5\), but not between load conditions \((F<1)\). This result suggests that a slight load is enough to enhance the occurrence of *-s* errors.

The sentence type factor also proved to be significant. Many more *-s* errors appeared with SP sentences (12.08%) than with PP sentences (5.97%). This trend corresponds to the now “classical” match–mismatch effect: Error proportions increase when the two nouns or pronouns preceding the verb mismatch (singular/plural vs plural/singular) in comparison with the match condition (Bock & Miller, 1991; Fayol et al., 1994).

The noun–verb confusability factor was also significant. The proportions of *-s* errors were significantly lower when the verb had no noun counterpart (1.46%) than when it did (12.81%) \(F(1,114) = 22.61, P < 0.01, \text{MSe} = 456.1\).
Moreover, the error rate in the N > V condition (19.17%) was significantly higher than in the V > N condition (6.46%) ($F(1,114) = 21.25, P < 0.01, MSe = 456.1$). This effect was qualified by two significant interactions: load × noun–verb confusability and sentence type × noun–verb confusability. There were no other significant interactions.

In order to analyse the two interaction effects further, three different analyses were conducted, one for each load condition (i.e. zero, three and five words). In the zero-word load condition, no effects were significant ($F$s < 1). In the three-word load condition, the effects of sentence type [$F(1,19) = 4.11, P < 0.06, MSe = 324.6$] and noun–verb confusability [$F(2,38) = 11.73, P < 0.01, MSe = 596.5$] were significant, as was their interaction [$F(2,38) = 4.15, P < 0.05, MSe = 216$]. Subsequent contrast analyses revealed that the match–mismatch effect (i.e. more errors with SP sentences than with PP sentences) was significant only in the N > V condition [$F(1,38) = 14.18, P < 0.01, MSe = 216$].

In the five-word condition, we again found significant sentence type [$F(1,19) = 8.05, P < 0.05, MSe = 404.3$] and noun–verb confusability [$F(2,38) = 10.02, P < 0.01, MSe = 671.3$] effects. Once more there were more errors with SP (18.75%) than with PP (8.33%) sentences. Verbs having a noun homophone counterpart were more frequently erroneous than verbs without noun homophones (19.38 vs 1.88%) [$F(1,38) = 12.16, P < 0.01, MSe = 671.3$], and the verb frequency effect was also significant (27.5% with N > V; 11.25% with V > N) [$F(1,38) = 7.87, P < 0.01, MSe = 671.3$]. Contrast analyses showed that, as in the three-word load condition, the match–mismatch effect was only significant with N > V [$F(1,38) = 7.31, P < 0.01, MSe = 547.42$].
In summary, -s errors occurred almost exclusively when working memory was overloaded, even slightly so (i.e. three-word load). Their occurrence was much more frequent both when the two pronouns mismatched (SP condition) and, more interestingly, when the verb had a noun homophone that was more frequent (i.e. N > V condition). Moreover, in the five-word load condition, the proportion of -s errors was still the highest when the noun homophone was more frequent than its verb counterpart. In addition, a new trend appeared. The -s error rate increased steadily even when the verb homophone was more frequent than the noun (i.e. V > N condition). This suggests that, as soon as any verb has a noun homophone, this noun is automatically activated, as well as the verb. However, the strength and/or the speed of activation depends on the relative frequencies of the noun–verb occurrences. When the noun is much more frequent, it “wins” easily and quickly, even under a small load. In contrast, when the verb is the most frequent, the noun inflections only “win” sometimes, when the working-memory load is large enough to disrupt the agreement process. We elaborate further on this interpretation in the Discussion.

**Word Recall Analysis.** As there was almost no variation in recall in the three-word condition, only the data for the five-word load condition were analysed with a 3 (sentence type: SP, PS, PP) × 3 (noun–verb confusability: N ≠ V, N > V, V > N) ANOVA with repeated measures on each factor. The dependent variable was the number of words recalled (out of 5) under each condition.

The sentence type effect, the noun–verb confusability effect and their interaction were all significant. The number of words recalled decreased significantly in the N > V (3.36) condition compared with the V > N (3.63) and V ≠ N (3.67) conditions, and in the PS (3.38) condition compared with the SP (3.68) and PP (3.60) conditions. As far as the interaction was concerned, fewer words were recalled when the participants dealt with N > V verbs under the two mismatch conditions (3.43 and 2.97 in the SP and PS conditions, respectively).

The results of Experiment 1 were clear and consistent with our predictions. Indeed, the homophone effect was experimentally induced: The participants frequently wrote down verbs having noun homophones as if they were nouns—that is, inflecting them with -s in the plural. In line with previous studies, the proportions of these errors were particularly high when the written recall took place under secondary task conditions. Moreover, the higher the load, the more frequent the errors. Interestingly, the number of words recalled (in the five-word load condition) decreased significantly in the N > V condition. And the homophone effect increased steadily when the noun homophone was more frequent than its verbal counterpart. This effect still occurred when the verb was the most frequent. However, it was much
more difficult to trigger, since it only showed up in the five-word load condition. Finally, plural noun inflections were very rare when the verb had no noun homophone, maybe as an artefact of the experimental situation.

The above results suggest that a secondary task helps to enhance those homophone confusions that are rarely apparent under normal conditions. However, three problems arise with these data. First, the frequencies of the items (noun/verbs) collapsed two different criteria: the relative frequencies of the noun homophones over their verb counterparts and the absolute frequencies of these items, as can be seen in Table 1. Second, the secondary task consisted of words to be recalled. Unfortunately, a number of these words were nouns. As a consequence, we suspect that at least some of the erroneous noun inflections were induced by a “noun atmosphere” favouring the noun-inflection set at the expense of the verb set. The last problem was the absence of item analyses. All these critical points were addressed in two control experiments (1A and 1B).

CONTROL EXPERIMENT 1A

The aim of Control Experiment 1A was two-fold; first, we wished to assess the reliability of the homophone effect across items; second, there was one potential confound in the material of Experiment 1. The homophones were chosen in such a way that the frequency of one category (i.e. noun vs verb) was at least twice as high as the frequency of the other category. For example, griffe {claw} has a frequency of 1016 as a noun, whereas griffe(r) {(to) scratch} has a frequency of 221 as a verb. The reverse is true for filtrre (frequency 680 as a verb against 148 as a noun). However, in controlling this relative frequency we did not take the absolute frequency of words into account. As a result, the mean frequency of verbs (7815) was superior to the mean frequency of nouns (5775), although not significantly so \( t(11) < 1 \). This difference in absolute frequency could, at least partially, be responsible for some of the effects that were observed in Experiment 1. In addition, this absolute frequency could interact with relative noun–verb frequencies.

In order to overcome these shortcomings, the experiment was carried out using a new series of sentences. As we wanted to have enough material to test the predictions with both participants and items, and as the number of noun–verb homophones is limited in the French language, we restricted the range of sentence types. Only SP sentences were used because they are the most likely to induce the homophone effect. In addition, a (partially) new set of words was selected in order to control both for the absolute frequency (high vs low frequency) and the noun–verb relative frequency of homophone words.
Method and Procedure

Forty-eight undergraduate students (26 females, 22 males) at the University of the Bourgogne, Dijon, France (mean age 18.6 years:months; range 17.8–21.1 years:months) recalled 48 sequences of two sentences each followed or not by three- or five-word lists. The series of sentences were randomised and divided into two blocks of 24 sequences. The order of the blocks was counterbalanced across subjects. Each participant was randomly assigned to one of the six experimental conditions, defined by the memory load and the order of block combination.

The sentences were constructed in the same way as those in Experiment 1. Sixteen sequences of two sentences each were composed, the second of which contained the agreement problem. All the second sentences were of the SP type. The main modification compared with Experiment 1 concerned the verbs. Within the 16 experimental verbs, 8 had a frequency higher than 5700 (i.e. high-frequency verbs) and 8 had a frequency lower than 2250 (i.e. low-frequency verbs). In addition, half of the verbs in each of the frequency categories were verbs whose frequency outnumbered the corresponding noun homophone’s frequency (V > N condition), whereas the reverse was true for the other half (N > V condition) (Table 3). The corresponding sentences are given in Appendix 2. For the “sentence + words” conditions, 48 lists of three or five monosyllabic words were drawn up as in Experiment 1.

The same scoring procedure as in Experiment 1 was used. However, as there were no -s errors in the zero-word load condition, the mean proportions of -s errors were analysed using a 2 (load: three vs five) × 2 (absolute frequency: high vs low) × 2 (noun–verb relative frequency: N > V vs V > N) mixed-design ANOVA with repeated measures on the last two factors.

Results and Discussion

As in Experiment 1, the participants made no agreement errors in the spelling-ability control task. In the recall task, only 37 of 768 sentences were discarded (4.8%) due to erroneous recall or to pronoun modifications. Interestingly, the number of these errors increased with the load (0, 4 and 33 errors with 0, 3 and 5 words to recall, respectively). Here again, verb agreement errors were mainly -s errors (14.96% vs 4.56% for -nt errors).

-s Error Analysis. The percentages of -s errors are shown in Fig. 1. There were significantly more -s errors in the five-word (21.97%) than in the three-word (7.94%) load condition. Also, these -s errors were much more frequent in the N > V (18.72%) than in the V > N (11.19%) condition. As can be seen in Table 4, no other effect or interaction was significant with participants or items as random factors.
The number of words recalled varied only in the five-word load condition. The statistical analysis conducted in this condition showed a significant effect of noun–verb relative frequency. As expected, more nouns were recalled in the V > N condition (3.88) than in the N > V condition (3.53): working memory was particularly overloaded when the noun homophones were more frequent than the verb homophones. Finally, the absolute frequency × relative frequency interaction effect was significant. The number of words recalled was especially low when the target verb was rare and when the verb had a more frequent noun homophone (3.42) compared with the other conditions (verb > 5700, N > V: 3.64; verb > 5700, V > N: 3.84; verb < 2250, V > N: 3.92).

<table>
<thead>
<tr>
<th>Relative Frequency</th>
<th>Verb &gt; 5700</th>
<th>Verb &lt; 2250</th>
</tr>
</thead>
<tbody>
<tr>
<td>N &gt; V</td>
<td></td>
<td></td>
</tr>
<tr>
<td>forcer [to open]</td>
<td>force [strength]</td>
<td>formuler [to state]</td>
</tr>
<tr>
<td>(5777)</td>
<td>(52,685)</td>
<td>(1599)</td>
</tr>
<tr>
<td>former [to train]</td>
<td>forme [shape]</td>
<td>limiter [to limit]</td>
</tr>
<tr>
<td>(14,741)</td>
<td>(39,569)</td>
<td>(1612)</td>
</tr>
<tr>
<td>livrer [to deliver]</td>
<td>livre [book]</td>
<td>planter [to plant]</td>
</tr>
<tr>
<td>(6892)</td>
<td>(37,080)</td>
<td>(1637)</td>
</tr>
<tr>
<td>placer [to arrange]</td>
<td>place [place]</td>
<td>tracer [to draw]</td>
</tr>
<tr>
<td>(6589)</td>
<td>(43,313)</td>
<td>(2025)</td>
</tr>
<tr>
<td>V &gt; N</td>
<td></td>
<td></td>
</tr>
<tr>
<td>conserver [to keep]</td>
<td>conserve [can]</td>
<td>filtrer [to filter]</td>
</tr>
<tr>
<td>(5722)</td>
<td>(455)</td>
<td>(680)</td>
</tr>
<tr>
<td>fermer [to close]</td>
<td>ferme [farm]</td>
<td>fouiller [to rummage]</td>
</tr>
<tr>
<td>(9636)</td>
<td>(3475)</td>
<td>(2212)</td>
</tr>
<tr>
<td>marquer [to mark]</td>
<td>marque [mark]</td>
<td>répliquer [to repeat]</td>
</tr>
<tr>
<td>(7576)</td>
<td>(3473)</td>
<td>(2076)</td>
</tr>
<tr>
<td>tromper [to cheat]</td>
<td>trompe [trunk]</td>
<td>trancher [to chop]</td>
</tr>
<tr>
<td>(10,580)</td>
<td>(812)</td>
<td>(1671)</td>
</tr>
</tbody>
</table>
The results of this first control experiment confirm and extend those of Experiment 1. The noun–verb confusability effect was again found and appeared whatever the absolute frequency of the target verbs. This homophone effect proved significant with both participants and items as random factors. So, this control experiment ruled out the absolute frequency potential confound and replicated the enhancement of the homophone effect under the working-memory load condition.

**FIG. 1.** Percentages of -s errors as a function of working-memory load and of absolute and relative verb frequencies (Control Experiment 1A).

<table>
<thead>
<tr>
<th>Effects</th>
<th>df</th>
<th>MSe</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>-s error (with participants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>1.30</td>
<td>925.9</td>
<td>6.81a</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.30</td>
<td>252.2</td>
<td>7.20a</td>
</tr>
<tr>
<td>-s error (with items)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Load</td>
<td>1.12</td>
<td>68.1</td>
<td>25.30b</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.12</td>
<td>43.4</td>
<td>16.59b</td>
</tr>
<tr>
<td>Word recall (with participants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.15</td>
<td>1.11</td>
<td>26.95b</td>
</tr>
<tr>
<td>Absolute frequency × relative frequency</td>
<td>1.15</td>
<td>0.07</td>
<td>5.09a</td>
</tr>
<tr>
<td>Word recall (with items)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.12</td>
<td>0.49</td>
<td>20.92b</td>
</tr>
<tr>
<td>Absolute frequency × relative frequency</td>
<td>1.12</td>
<td>0.02</td>
<td>3.92a</td>
</tr>
</tbody>
</table>

* P < 0.05; ** P < 0.01.
CONTROL EXPERIMENT 1B

Control Experiment 1B was aimed at ruling out another potential confound of Experiment 1. The secondary task consisted of words to recall, some of which were nouns. As such, they could have triggered a kind of “atmosphere effect”, favouring the occurrence of noun inflections instead of verb inflections. We devised a new experiment using nonwords as a secondary task. Nonwords were chosen, instead of adjectives or adverbs for example, because we believed it less likely that they would induce any “atmosphere effect” via direct or indirect associations with other words appearing in the sentences.

Method and Procedure

Sixteen new undergraduate students (9 females, 7 males) at the University of the Bourgogne (mean age 19:1 years:months; range 17.9–22.3 years:months) recalled the same sentences as in Control Experiment 1A but a new set of items was devised as a secondary task. Thirty-two series of five nonwords were constructed with the constraint that each nonword was a monosyllabic CVC string (e.g. mic, fop, lur, bat, vec).

Results and Discussion

No errors occurred in the spelling control task. In the recall task, 49 out of the 256 sentences were discarded: 44 were partially recalled or not at all; the remaining 5 sentences contained a word substitution. The global quality of the recall task (19%) was thus slightly lower than in Control Experiment 1A (13%). However, the difference in the error proportions was not significant (z = 1.85). The following analysis was undertaken on the 207 acceptable sentences only. The agreement errors were mainly -s errors (28.65% vs 9.66% for -nt errors). The percentages of -s errors are presented in Fig. 2. The ANOVA on the percentages of erroneous inflection graphemes showed an effect of noun–verb relative frequency only $F_1(1,15) = 6.22, P < 0.05, \text{MSE} = 410.2; F_2(1,12) = 11.98, P < 0.01, \text{MSE} = 50.1$. There were more -s errors in the N > V (34.97%) than in the V > N (22.34%) condition. There were no other effects or interactions. The pattern of results was thus very similar to that observed in Control Experiment 1A.

We compared the data from Control Experiments 1A and 1B under the two secondary task conditions. A 2 (load: five words vs five nonwords) × 2 (absolute frequency: high vs low) × 2 (relative frequency: N > V vs V > N) ANOVA yielded neither significant effects of load nor interactions with load (all $F_1 < 1; F_2 = \text{NS}$). Although the frequency of -s errors increased slightly in
Experiment 1B (28.65%) compared with Experiment 1A (21.97%), the pattern of errors was the same.

A two-way (absolute frequency × noun–verb relative frequency) analysis of variance on the number of nonwords recalled revealed no significant main or interaction effects, with participants or items ($F_{s} < 1$). The number of nonwords remained low and approximately constant (about 1.75) under all conditions.

The data from both Experiments 1A and 1B (five-word load condition only) were analysed using a three-way analysis of variance (words vs nonwords × absolute frequency × noun–verb relative frequency) with repeated measures on the last two factors. There was a reliable effect of load [$F_{1}(1,30) = 153.25, P < 0.01, MSe = 0.8; F_{2}(1,12) = 1032.65, P < 0.01, MSe = 0.03$] and a reliable load × noun–verb relative frequency interaction [$F_{1}(1,30) = 6.3, P < 0.05, MSe = 0.09; F_{2}(1,12) = 5.27, P < 0.05, MSe = 0.03$].

The mean number of words recalled (3.71) was more than twice the number of nonwords (1.75). Moreover, only the former varied in relation to noun–verb relative frequency (3.53 and 3.88 under the N > V and V > N conditions, respectively [$F_{1}(1,30) = 10.89, P < 0.01, MSe = 0.09; F_{2}(1,12) = 8.17, P < 0.05, MSe = 0.03$]. There was a floor effect with the nonwords: The subjects were unable to recall more than about two nonwords, and thus there was no variation as a function of the different conditions.

Overall, the data from Control Experiment 1B ruled out the “noun atmosphere” effect potential confound, since using nonwords or words as a load led to the same error pattern—the -s errors occurred more often in the N > V condition.
In the first three experiments, the subjects had to transcribe sentences that were orally presented. In order to explain that they sometimes made homophone errors, we assumed that the to-be-transcribed verbs could receive activation from two different sources. First, activation could come from the phonological level: every phoneme was supposed to be linked to the set of graphemes it is associated with. However, in so far as some phoneme–morpheme associations are more frequent than others, it was expected that some graphemes would be activated more and would thus tend to show up more rapidly to fill in the grapheme-slots of the to-be-agreed verbs. Second, we assumed that due to the task—an oral sentence had to be maintained in working memory before being transcribed—the phonological level could activate the word level, and thus the morphological level. Because we used pairs of word homophones and the two members of each pair had different frequencies of occurrence, we expected that the most frequent of the terms would in turn activate more strongly the grapheme corresponding to its inflection. This is precisely what occurred: the -s inflection very often intruded when the noun of the homophone pair was the most frequent. We were thus led to conclude that some characteristics of the words composing the sentences influenced the grapheme activation process beyond the differential activation related to the phoneme–grapheme links. The following two experiments were aimed at providing still more evidence regarding the impact of the word effect on the elicitation of the homophone effect, as shown in -s agreement errors.

The rationale was that the relative frequency of occurrence of noun–verb homophones was only one determinant of the error effect. Indeed, in most activation models, frequency acts on the threshold level of activation of the nodes—the more frequent an item, the lower its threshold and the easier its activation. However, the threshold can be lowered when the node receives some pre-activation. Such pre-activation of the target word (here the word to be inflected) could be obtained via the sentence context (Balota, Boland, & Shields, 1989). This sentence context can be manipulated by increasing or decreasing the associative relatedness between the target and the meaning associated to the previous part and/or some of the other words in the sentence.

Suppose that we have a noun–verb homophone and that the two terms of this pair have quite different meanings. Such a condition is hard to fulfil, but it is tractable within certain limits (Jescheniak & Levelt, 1994). An example in French would be the word asperge. On the one hand, as a noun, it means a vegetable (une asperge {an asparagus}); on the other, as a verb, it describes a kind of watering (asperger {to sprinkle}). These two meanings are different enough to possibly increase the plausibility of one without increasing the
plausibility of the other at the same time. The meaning of the noun could be primed by elaborating a relevant context stressing the growing of vegetables, such as in a sentence like *Le jardinier sort les légumes et il lesasperge* [The gardener takes the vegetables out and sprinkles them]. Both “gardener” and “vegetables” are related associates of asparagus. Similarly, the verb meaning could be primed as well, like in *L’éléphant voit les clowns et il lesasperge* [The elephant sees the clowns and sprinkles them]. Elephant, because of its trunk, and clowns, due to their jokes, could be associated with the action of sprinkling.

Increasing the associative relatedness of the target word with some items preceding it in the sentence would prime the meaning corresponding to the associates and modify the level of the target, be it a noun or verb. It was expected that such modification would pre-activate the noun or verb homophone and the corresponding morphological structures. Following the results of the previous experiments, this would entail the occurrence of more -s errors when the noun meaning is primed, and less -s errors when the verb meaning is primed.

In summary, the following experiments were aimed at testing the hypothesis that priming one of the terms of a pair of noun–verb homophones having clearly different meanings would modify the frequency of occurrence of -s errors as graphemic inflections of verbs.

**Method**

**Subjects**

Forty-eight students participated in the experiments: 24 in Experiment 3A (14 females and 10 males; mean age 18:2 years:months; range 17:11–19:3 years:months) and 24 in Experiment 3B (14 females and 10 males; mean age 18:7 years:months; range 17:9–21:6 years:months).

**Stimuli**

The stimuli comprised both sentences and word lists. The word lists were the same as those used in Control Experiment 1A and were assigned to the experimental and filler sentences following the same rules. A new set of sentences including noun–verb homophones was devised in three steps, the first two being common to the two experiments.

**Selection of Noun–Verb Homophones.** Homophones not related in meaning are rare and the degree of relatedness between the two meanings is sometimes hard to assess. Therefore, we pre-selected a pool of 150 noun–verb homophones. These pairs were presented to 20 students, who did
not participate in the later experiments. The students were instructed to assess on a 5-point scale the degree of semantic relatedness between the two elements of each pair. Twenty noun–verb pairs judged as being the least semantically related were selected.

**Elaboration of Sentence Contexts.** In the next step, only eight verbs were kept due to the constraints of the absolute and relative frequencies of occurrence. The frequencies of the corresponding nouns and verbs and their degrees of (assessed) semantic relatedness are shown in Table 5.

Three independent judges then elaborated on intuitive grounds six context sentences for each word, three of which were supposed to be

<table>
<thead>
<tr>
<th>Relative Frequency</th>
<th>Verb</th>
<th>Noun</th>
<th>DSR (out of 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N &gt; V</td>
<td>asperger {to sprinkle}</td>
<td>asperge {asparagus}</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>classer {to file}</td>
<td>classe {class}</td>
<td>1.6</td>
</tr>
<tr>
<td></td>
<td>livrer {to deliver}</td>
<td>livre {book}</td>
<td>1.3</td>
</tr>
<tr>
<td></td>
<td>porter {to carry}</td>
<td>porte {door}</td>
<td>1.5</td>
</tr>
<tr>
<td>V &gt; N</td>
<td>briser {to break}</td>
<td>brise {breeze}</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>fermer {to close}</td>
<td>ferme {farm}</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>montrer {to show}</td>
<td>montre {watch}</td>
<td>1.4</td>
</tr>
<tr>
<td></td>
<td>tromper {to cheat}</td>
<td>trompe {trunk}</td>
<td>1.2</td>
</tr>
</tbody>
</table>
noun-meaning inducing and three verb-meaning inducing. A new group of 40 students received the 48 (6 sentences per word × 8 words) sentences, each one printed on one page of a booklet. The order of the pages was pseudo-randomised; the same word did not occur twice ever two successive pages. Moreover, the order of the pages followed a circular permutation. Again, the students were asked to use a 5-point scale to judge the degree of meaning relatedness of each sentence context as a whole (which was presented without the target word inserted), with the target word placed at the end of the line on which the sentence was printed. The target word was given either in its nominal (i.e. preceded by a plural article like in *les fermes* {the farms}), or in its verbal (i.e. infinitive like *fermer* {to close}) form. Sixteen sentences were selected (eight noun-biased and eight verb-biased), which depicted the strongest relatedness with the noun and the verb meanings of the sentence, respectively. In addition, instead of using sequences of two juxtaposed sentences, as in the previous experiments, we used sentences comprised of two clauses linked by the connective *et* {and}. This kind of sentence structure was used to maximise the likelihood of observing a priming effect of the sentence context upon the noun–verb homophones (see sentences in Appendix 3).

**Organisation of Sentence Blocks.** In Experiment 2A, each subject had to deal with the eight homophones (4 N > V; 4 V > N), but each of them only under one condition: either in a noun-biased (*n* = 4) or in a verb-biased (*n* = 4) condition. Half of the participants received the first four words in the noun context and the other four in the verb context; the other half received the same words in the reverse order. The eight experimental sentences were mixed with 24 filler sentences, extracted from those used in Control Experiment 1A, 8 following the “pronoun1 pronoun2 verb” pattern and 16 containing no or only one pronoun. Half of the 24 subjects performed the task with, and the other half without, the secondary task.

In Experiment 2B, the eight (4 N > V; 4 V > N) experimental sentences were seen by all the participants, half in a noun-biased condition and half in a verb-biased condition. These sentences were mixed with the same fillers as in Experiment 2A. All the subjects were tested under the secondary task condition.

**Procedure**

The procedure and instructions were the same as in the previous experiments. After the recall task, the subjects were given the usual spelling-ability task.
Results of Experiment 2A

There were no errors in the spelling-ability control task and only one in the recall task without any load. Therefore, statistical analysis of the data was restricted to the sentences + words condition. In this secondary task condition, 8 of 96 sentences were discarded (8.33%) because of partial or erroneous recall. Twenty errors (22.73%) occurred on the 88 remaining sentences, 12 of which consisted of -s (13.64%) an 8 of -nt graphemes (9.09%) use as verb inflections. As -nt errors are not pertinent to the present study, -s errors only were analysed in a 2 (biasing context: noun- vs verb-biasing) × 2 (relative frequency: N > V vs V > N) ANOVA with repeated measures.

-s Error Analysis. The proportion of -s errors (Fig. 3) increased as expected. Indeed, the biasing context effect was significant: there were more errors in the noun-biasing (20.83%) than the verb-biasing (4.17%) context \[F(1,11) = 8.8, P < 0.05, \text{MSE} = 378.8\]. The relative frequency effect was also significant: there were more errors in the N > V (20.83%) than in the V > N (4.17%) condition \[F(1,11) = 5.5, P < 0.05, \text{MSE} = 606.6\]. Planned comparisons showed that the biasing-context effect almost reached significance in the N > V condition \(F(1,11) = 4.5, P = 0.06, \text{MSE} = 833.3\), but not in the V > N condition \(F < 1\): more -s errors were observed with noun-biasing (37.5%) than with verb-biasing (8.33%) in the N > V condition.

Word Recall Analysis. The two-way (relative frequency × biasing context) analysis of variance of the number of words recalled showed only a significant effect of the N > V (3.42)/V > N (3.94) condition \[F(1,11) = 6.3, P < 0.05, \text{MSE} = 0.52\]. Planned comparisons showed that the context effect was clearly non-significant in the V > N condition (4.01 and 3.88 in the noun- and verb-biasing conditions, respectively; \(F<1\), but almost reached significance in the N > V condition (3.67 and 3.17 in the noun- and verb-biasing conditions, respectively) \[F(1,11) = 4.34, P = 0.06, \text{MSE} = 0.35\].

In summary, in Experiment 2A, there was an increase in the number of -s errors only when the sentence context primed the noun-homophone in the N > V condition. As in previous experiments, fewer words were recalled when noun frequency was greater than verb frequency; however, there was also a trend for recall scores to be weaker under the biased verbal context in conjunction with the N > V condition.

Results of Experiment 2B

There were no errors in the spelling-ability control task. In the sentences + words recall condition, 15 sentences (7.8%) were discarded due to erroneous recall (3.69%) or pronoun modifications (4.17%). The verb inflection errors
TABLE 6
Significant Effects ($F_1$ and $F_2$) in Experiment 2B for Both -s Error and Word Recall (out of 5) Analyses

<table>
<thead>
<tr>
<th>Effects</th>
<th>$df$</th>
<th>$MSe$</th>
<th>$F$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-s error (with participants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biasing context</td>
<td>1.22</td>
<td>581.6</td>
<td>5.27</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.22</td>
<td>273.6</td>
<td>11.15</td>
</tr>
<tr>
<td>Biasing context × relative frequency</td>
<td>1.22</td>
<td>273.6</td>
<td>7.65</td>
</tr>
<tr>
<td>-s error (with items)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biasing context</td>
<td>1.6</td>
<td>81.6</td>
<td>28.23</td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.6</td>
<td>79.1</td>
<td>15.48</td>
</tr>
<tr>
<td>Biasing context × relative frequency</td>
<td>1.6</td>
<td>58.9</td>
<td>11.4</td>
</tr>
<tr>
<td>Word recall (with participants)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative frequency</td>
<td>1.22</td>
<td>0.15</td>
<td>14.81</td>
</tr>
<tr>
<td>Biasing context × relative frequency</td>
<td>1.22</td>
<td>0.15</td>
<td>7.03</td>
</tr>
<tr>
<td>Word recall (with items)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biasing context × relative frequency</td>
<td>1.6</td>
<td>0.06</td>
<td>5.97</td>
</tr>
</tbody>
</table>

$a P < 0.05; \quad b P < 0.01.$

(39 of 177 acceptable sentences; 22.43%) were either -s ($n = 24; 13.56\%$) or -nt ($n = 15; 8.47\%$) errors. The same trends as those seen in Experiment 2A were observed. The relevant data (-s errors and recalled words) were submitted to a two-way biasing context × relative frequency ANOVA with repeated measures on the last factor (Table 6).

-s Error Analysis. As shown in Fig. 3, there were significantly more errors in the noun-biasing (25.01%) compared with the verb-biasing (3.45%) context. There were also more errors in the N > V (22.21%) than in the V > N (6.25%) condition. The interaction proved to be significant. Planned comparisons showed that the biasing context effect was significant in the N > V condition {$F_1(1,22) = 37.58, P < 0.01, MSe = 581.63; F_2(1,6) = 28.23, P < 0.01, MSe = 79.13$}, but not in the V > N condition {$F_1(1,22) = 2.67, NS; F_2(1,6) = 4.58, NS$}.

Word Recall Analysis. Fewer words were recalled in the N > V (3.33) than in the V > N (3.77) condition. This relative frequency effect proved significant only with participants as a random factor. The biasing context × relative frequency interaction yielded a reliable effect. Planned comparisons showed that the biasing effect was only significant in the N > V condition (3.59 and 3.07 in the noun- and verb-biasing conditions, respectively, {$F_1(1,22) = 10.89, P < 0.01, MSe = 0.15; F_2(1,6) = 9.36, P < 0.05, MSe = 0.06$}.)
GENERAL DISCUSSION

One of the major problems in written language processing is dealing with cases where one phoneme can be matched onto several graphemes, as illustrated by the homophone effect. This one-to-many phoneme–grapheme correspondence is a source of spelling errors. These kinds of spelling errors are generally reported as being exceptional, either because they occur rarely in normal subjects as slips of the pen (Hotopf, 1980; 1983; Morton, 1980) or because they are observed in poor spellers (Frith, 1980). Viewing this homophone effect as an exceptional phenomenon might lead one to consider that this one-to-many phoneme–grapheme correspondence is easily (automatically, without cost and unconsciously) dealt with by the written language production system.

In the present study, we took a different perspective. We assumed that, in language processing, the cognitive system has very often to manage the one-to-many matching (e.g. in comprehension when one word has two meanings; in production when the same meaning can be conveyed by several words). The one-to-many phoneme–grapheme correspondence investigated here is only a specific case of this state of affairs.

The results of the present experiments provide clear evidence that the homophone effect can be induced in highly educated adults. This effect showed up through the confusion of noun–verb plural inflections in the French language. When in a “pronoun1 pronoun2 verb” sentence the verb had a noun homophone the frequency of which was higher than the frequency of the verb, the erroneous inflection was very often -s, the plural of
nouns. This effect was enhanced when a secondary task was added and the working-memory system overloaded. Moreover, when the noun meaning was primed by the semantic context, this effect was even greater.

The data reported here can be explained within an activation model. In such a model, a morpheme is selected when it has accumulated enough activation to reach its threshold level. This activation comes from all the activated relationships (i.e. semantic, syntactic, lexical and phonological) the morpheme is involved in. The process of activation is time- and/or resource-dependent. When there is enough time or resources, the activation can return to resting level. Accordingly, all the relevant dimensions have been taken into account, and thus the probability of errors is weak. By contrast, when time (or resources) is limited, errors should occur more frequently because only the strongest links would be activated.

The processes of language production can be divided into a number of steps (Bock & Levelt, 1994). First, the message level takes into account the speaker’s/writer’s intended meaning (for example, that there are several objects from the same category—several stamps or watches or several people showing something) and feeds the formulator component with the corresponding information (Levelt, 1989). Then, the grammatical encoding processes select the lemmas associated with lexical concepts and assign grammatical functions. Lemmas carry information about grammatical categories (noun vs verbs) and gender. At this level, for example, an item is marked as (+ PLURAL) (MacKay, 1979) without specifying the mark it will take (i.e. stamp (+ PLURAL)). The next two steps (i.e. the positional level) deal first with the assembly and ordering of constituents and second the generation of inflections. At this positional level, words are represented according to their morphological constituents, stems and affixes (Rapp, 1992). For example, timbre [stamp] is linked both to -s as a noun and to -nt as a verb. The positional level is the locus of the homophone effect: several lemmas (i.e. noun vs verb) converge on the same phonological stem. The positional level is also the locus of the frequency effect (Jescheniak & Levelt, 1994): the more frequent an item, the more easily it is activated. Such a differential activation remains undetectable when homophones are also homographs, which means that the noun stem timbre [stamp] is more easily activated than its verb counterpart (see Table 1), but this does not show up in the singular forms. It is assumed that stem frequency also determines the probability of the graphemic form of the stem (“seen” vs “scene”), the probability of activating the paradigm(s) of graphemic inflections the stem is associated with (e.g. the noun vs verb paradigm), and the relative probability of the different graphemic marks belonging to the same paradigm (i.e. -e vs -s for the noun paradigm). Thus, as regards timbre, the -s inflection is more available than the -nt inflection, while the reverse is true concerning montre (i.e. -nt is more available than -s) (see Table 1).
Concerning one-to-many phoneme–grapheme correspondence, the activation model assumes that all the graphemic nodes associated with a phonological and/or a morphological node are activated in parallel with different strengths. In general, the most frequent node wins when time is limited. Dell (1986) provided evidence through a simulation that such an explanation could account for the frequency of occurrence of speech errors. As writing is a relatively slow activity (compared with speech), it seems highly likely that the activation process has generally enough time to be completed. This explanation is coherent both with the rarity of -s/-nt exchanges in verb inflections in ordinary writing, and with the observation that blends are rarer in writing than in speech (Hotopf, 1980; 1983). Typically, homophone errors are relatively rare, even if potential graphemic errors are always activated, because the production system can take into account all the relevant sources of activation and then “select” the adequate grapheme. In addition, the relative slow pace of writing enables writers to monitor its production more easily (Berg, 1986; Chanquoy, Foulin, & Fayol, 1990; Fayol, 1991; Levelt, 1989). Both activation decay and production monitoring could be at stake in standard writing tasks. Further empirical studies are needed to determine whether these two processes are necessary or if only one of them is sufficient.

The two foregoing hypothesised processes—activation decay and production monitoring—can also help us to understand the enhancing effect of the secondary task. Adding a secondary task led to a steady increase in the proportion of errors. It could thus be concluded that increasing the working-memory load disrupted the selection of the correct agreement (Fayol et al., 1994). However, this disruption could have occurred via at least two different mechanisms: impedance of the activation completion or hindering of monitoring. On the one hand, impeding the activation process—for example, through preventing the spreading of the weakest activation—would only promote -s errors when a noun homophone is activated more than its verb counterpart because the -nt ending is not strong enough to reach the level necessary to compete for the inflection slot. Such -s errors would not occur when verb frequency was greater than noun frequency. In this latter case, if only the weakest connections were disrupted, these connections would be those linking the verb to the -s grapheme. The data of Experiment 1 fit nicely with this interpretation: even a slight memory load was disrupting enough with N > V but not with V > N verbs. On the other hand, if the activation process was not (the only) affected, the secondary task could have constrained the amount of cognitive resources available. This constraint could hinder the monitoring function of the working-memory system. As a conflict exists between two graphemes competing for the same slot, the monitoring system should watch for all the available cues to compute the relevant graphemic inflection. Following
Carpenter and co-workers' (1994) computational conception of working memory, any storage load increase leads to a decrease in the amount of resources devoted to the computational component. The proportions of errors thus augment because this component can no longer do its job—that is, take into account all the information needed to select the relevant grapheme.

The current experiments provide no compelling evidence for either of these hypotheses. However, the data regarding recall of series of words provides some hints concerning the impact of the secondary task. We assume that the number of recalled words provides an indication of the amount of cognitive resources involved in the management of graphemic competition; that is, the more difficult the resolution of the conflict, the poorer will be recall performance.

The global recall results of Experiments 1, 1A, 2A and 2B showed that the number of words recalled was always significantly greater in the V > N than in the N > V condition. This finding can easily be interpreted. Grapheme competition is stronger when the noun homophone receives a greater amount of activation because of its greater frequency. Resolving the conflict between graphemes is thus more resource-consuming in the N > V condition, which results in a reduction in recall performance (Fayol et al., 1994).

The relationship between the proportion of errors and the number of words recalled was somewhat paradoxical when the biasing context × relative frequency interaction in Experiments 2A and 2B was taken into account. Indeed, the highest error percentage (under noun-biased and N > V conditions) was not associated with the poorest performance recall (under verb-biased and N > V conditions). Post-hoc HSD Tukey tests confirmed that the recall scores did not differ between N > V and V > N in the noun-biasing context in Experiments 2A and 2B, and were rather high. In contrast, these scores differed significantly between N > V and V > N in the verb-biasing context in Experiments 2A and 2B. These findings are in part better accommodated following Berg’s (1986) proposals.

Monitoring activity is an automatic by-product of the bottom-up spread of activation. As the activation level of any item depends on the activation of its semantic, lexical, syntactic, phonological and graphemic features, the more similar two items are, the more likely the non-target is to intrude. This was especially the case in the first three experiments, since as we did not control the meaning of the noun–verb homophones, most of them may have had very close meanings: three independent judges estimated that this was the case for 10 of the 12 noun–verb pairs in Experiment 1 and for 8 of the 16 pairs (and 3 others were very difficult to assess) in Control Experiments 1A and 1B. Therefore, increasing the activation of one item at the expense of the other increased the risks of intrusion. And this is clearly what occurred: the
most activated item was selected, which yielded -s errors when it was
the noun homophone.

On this perspective, the speaker (and the writer) takes into account the
activation values of nodes. When the activation level of an item is high
even, this item is accepted as a plausible candidate by the monitoring
system (Lemaire & Fayol, 1995; Lemaire, Fayol, & Abdi, 1991; Lemaire,
Barrett, Fayol, & Abdi, 1994). Conversely, if the activation is insufficient, a
problem will be detected. Our results fit nicely with this conception. It might
be added that, when an inconsistency is surmised, the production system
processes the data again, which both takes time and burdens working
memory.

This conception helps to explain that, when the level of activation of the
noun homophone was high enough, due to its favourable frequency and
context, many -s errors intruded and were not detected. This conjunction of
circumstances entailed high recall scores (3.7 and 3.6 in Experiments 2A and
2B, respectively) associated with high error rates (37.5% and 39.6% in
Experiments 2A and 2B, respectively). It also explains how, when noun
homophone frequency was greater than verb homophone frequency and
was placed in a verb-biasing context, a conflict arose. This conflict was
resolved, leading to low error rates (8.3% and 4.8% in Experiments 2A and
2B, respectively), at the expense of recall performance (3.2 and 3.1 in
Experiments 2A and 2B, respectively). Finally, in the V > N and
verb-biasing context condition, the level of activation of the noun
homophone was very low, leading to low error rates (4.2% and 2.1% in
Experiments 2A and 2B, respectively) and to high recall performance (3.9
and 3.8 in Experiments 2A and 2B, respectively).

Interestingly, a problem arises when applying the foregoing conception to
the data as a whole. Indeed, a conflict was expected when the V > N
condition was combined with the noun-biasing context: there were neither
high error rates (even if the rate was slightly greater than under the two
verb-biasing conditions; 8.3% and 10.4% in Experiments 2A and 2B,
respectively), nor low recall scores (4 and 3.7 in Experiments 2A and 2B,
respectively). The asymmetry of the behaviour of the N > V and V > N pairs
of homophones when they were placed in a different biasing context raises a
problem. First, it could be that the noun-biasing context was not as strong as
the verb-biasing one. This possibility was weakly supported in the present
data, as shown by the dramatic increase in -s errors induced in the N > V
condition. However, this hypothesis remains to be tested. Second, the status
of the morphological marks of number could be quite different in nouns and
in verbs. Neuropsychological data provided evidence that nouns and verbs
have specific organisations at the semantic and lexical levels, and that their
grammatical category information is represented separately and
redundantly in each modality (oral vs written) system (Caramazza & Hillis,
It could be that the number information is semantically grounded and coded in nouns, whereas it is only a linguistic feature in verbs. It is well known that cardinality is related to noun entities but not to activity, which is clearly supported by developmental studies (Brown, 1973; Cazden, 1968; Keeney & Wolfe, 1972). If this second hypothesis is true, only nouns should be sensitive to semantic priming relevant to number morphology. By contrast, verbs should remain relatively unaffected by semantic priming concerning number. Further studies are required to test this prediction.

Finally, the results of the experiments reported here are consistent with the data collected in the ordinary settings of written production. In such settings, homophone effects are rare. However, when the syntactic configuration (“pronoun1 pronoun2 verb”) and the lexical constraints (verb having a more frequent noun homophone) are taken into account, these errors are less unusual. Moreover, the teachers who were interviewed concerning -s/nt exchanges all agreed that they occurred more often in highly formal and stressful situations; that is, in settings which are particularly resource-consuming for students (see Wing & Baddeley, 1980). In other words, even if the transcription task used here is not really considered to be a written production task (see Dell & O’Seaghdha, 1992; McDonald, Bock, & Kelly, 1993), it might at least constitute a reasonable simulation of written production under stress. We think this same task and the same experimental manipulations would be useful to study the homophone effect in general cases of word substitutions in several languages and to provide further insights into the cognitive mechanisms involved in written language production.

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REFERENCES


Test sentences

* Le chimiste prend des liquides. Il les filtre.
(The chemist takes some liquids. He filters them.)

* Le caissier prend des billets. Il les range.
(The cashier takes some notes. He sorts them out.)

* Le postier prend des paquets. Il les timbre.
(The postal clerk takes some parcels. He stamps them.)

* L’ouvrier prend des bidons. Il les verse.
(The worker takes some cans. He empties them.)

* Le vieux a des apprentis. Il les forme.
(The old man has some apprentices. He trains them.)

* Le rapace voit des mulots. Il les guette.
(The predator sees some field mice. He watches them.)

* Le charpentier prend des clous. Il les jette.
(The carpenter takes some nails. He throws them.)

* Le vagabond a des poches. Il les fouille.
(The vagabond has some pockets. He searches them.)

* Les gens cherchent un enfant. Ils le trouvent.
(The people look for a child. They find him.)

* Les pirates ont un trésor. Ils le gardent.
(The pirates have a treasure. They keep it.)

* Les soldats trouvent un espion. Ils le jugent.
(The soldiers find a spy. They judge him.)

* Les passants voient un blessé. Ils le soignent.
(The passers-by see a wounded person. They nurse him.)

* Les marins prennent un message. Ils le codent.
(The sailors take a message. They code it.)

* Les campeurs ont un journal. Ils le brûlent.
(The campers have a diary. They burn it.)

* Les voisins ont un studio. Ils le meublent.
(The neighbours have a studio. They furnish it.)

* Les musiciens aiment un air. Ils le chantent.
(The musicians like a melody. They sing it.)

* Les soudeurs souffrent des yeux. Ils les ferment.
(The welders’ eyes hurt. They close them.)

* Les enfants font des paris. Ils les gagnent.
(The children make some bets. They win them.)

* Les garçons font des erreurs. Ils les gomment.
(The boys make some mistakes. They erase them.)

* Les chasseurs voient des lapins. Ils les visent.
(The hunters see some rabbits. They shoot them.)

* Les dresseurs ont des panthères. Ils les montrent.
(The trainers have some panthers. They show them.)

* Les concurrents ont des pions. Ils les bougent.
(The competitors have some pawns. They move them.)

* Les chatons ont des coussins. Ils les griffent.
(The kittens have some pillows. They scratch them.)

* Les paysans ont des fruits. Ils les mangent.
(The peasants have some fruits. They eat them.)
THE HOMOPHONE EFFECT

Buffer sentences
* Le sportif est arrivé. Il transpire.
(The athlete has arrived. He sweats.)
* Alain rentre du marché. Il est tard.
(Alan comes back from the market. It is late.)
* Mon ami ouvre la cage. L'oiseau fuit.
(My friend opens the cage. The bird flees.)
* Toutes les brebis sont perdues. Le loup rôde.
(All the sheep are lost. The wolf prowls.)
* Isabelle voit des tulipes. Elle en coupe.
(Isabelle sees some tulips. She cuts some.)
* Les manifestants défilent. Ils s'énervent.
(The demonstrators march along. They get agitated.)
* Le jour vient de se lever. Il fait frais.
(The day has just begun. It is chilly.)
* Mon grand-père est fatigué. Il se couche.
(My grandfather is tired. He goes to bed.)
* L'élève est très appliqué. Il fatigue.
(The pupil is very careful. He gets tired.)
* Le maître voit une souris. Elle a peur.
(The teacher sees a mouse. She is scared.)
* Les vacances sont terminées. C'est trop triste.
(The vacation is over. It's too bad.)
* Le footballeur marque un but. On l'acclame.
(The soccer player scores a goal. He is applauded.)

APPENDIX 2: CONTROL EXPERIMENTS 1A and 1B

Test sentences
* Le fou a des idées. Il les formule.
(The madman has ideas. He states them.)
* Le roi a des amis. Il les conserve.
(The king has some friends. He keeps them.)
* Le paysan a des fruits. Il les livre.
(The peasant has some fruits. He delivers them.)
* Le saint a des envies. Il les limite.
(The saint has some desires. He limits them.)
* Le vieux a des apprentis. Il les forme.
(The old man has some apprentices. He trains them.)
* Le jardinier a des choux. Il les plante.
(The gardener has some cabbages. He plants them.)
* Le chef montre des chemins. Il les trace.
(The leader shows some trails. He draws them.)
* Le prof entend des mots. Il les réplique.
(The professor hears some words. He repeats them.)
* Le vendeur sort des objets. Il les place.
(The salesman takes some objects out. He arranges them.)
* Le soudeur souffre des yeux. Il les ferme.
(The welder’s eyes hurt. He closes them.)
* Le sorcier prend des liqueurs. Il les filtre.
(The wizard takes some liquors. He filters them.)
* Le charcutier prend des os. Il les tranche.
(The butcher takes some bones. He chops them.)
* Le banquier a des clients. Il les trompe.
(The banker has some clients. He cheats them.)
* Le voleur voit des coffres. Il les force.
(The thief sees some safes. He opens them.)
* Le marcheur voit des buissons. Il les fouille.
(The walker sees some bushes. He rummages them.)
* Le soldat a des habits. Il les marque.
(The soldier has some clothes. He marks them.)

Buffer sentences
* Les campeurs ont un journal. Ils le brûlent.
(The campers have a diary. They burn it.)
* Les gens cherchent un enfant. Ils le trouvent.
(The people look for a child. They find him.)
* Les Français trouvent un espion. Ils le jugent.
(The French find a spy. They judge him.)
* Les passants voient un blessé. Ils le soignent.
(The passers-by see a wounded person. They nurse him.)
* Les rapaces voient un mulot. Ils le guettent.
(The predators see a field mouse. They watch it.)
* Les pirates ont un trésor. Ils le gardent.
(The pirates have a treasure. They keep it.)
* Les postiers sortent un paquet. Ils le timbrent.
(The postal clerks take a parcel out. They stamp it.)
* Les musiciens aiment un air. Ils le chantent.
(The musicians like a melody. They sing it.)

* Les enfants font des paris. Ils les gagnent.
(The children make some bets. They win them.)
* Les chasseurs voient des lapins. Ils les visent.
(The hunters see some rabbits. They shoot them.)
* Les indiens cueillent des fruits. Ils les mangent.
(The Indians pick some fruits. They eat them.)
* Les cuisiniers font des plats. Ils les gouttent.
(The cooks make some dishes. They taste them.)
* Les voisins ont des raisins. Ils les pressent.
(The neighbours have some grapes. They press them.)
* Les marchands sortent des pullis. Ils les soldent.
(The salesmen take some sweaters out. They sell them.)
* Les pompiers ont des tuyaux. Ils les roulent.
(The firemen have some hoses. They roll them.)
* Les concurrents ont des pions. Ils les bougent.
(The competitors have some pawns. They move them.)

* Le sportif est arrivé. Il transpire.
(The athlete has arrived. He sweats.)
* Ton fils est bien éduqué. Il s’excuse.
(Your son is well mannered. He apologises.)
THE HOMOPHONE EFFECT

* Mon ami ouvre la cage. L’oiseau fuit. (My friend opens the cage. The bird flees.)
* Le jour vient de se lever. Il fait frais. (The day has just begun. It is chilly.)
* Mon réveil vient de sonner. Je m’habille. (My alarm clock just rang. I get dressed.)
* L’ordinateur est en panne. On patiente. (The computer breaks down. People wait.)
* Les manifestants défilent. Ils s’énerverent. (The demonstrators march along. They get agitated.)
* L’élève est très appliqué. Il fatigue. (The pupil is very careful. He gets tired.)
* Les vacances sont terminées. C’est trop triste. (The vacation is over. It’s too bad.)
* La maîtresse voit une souris. Elle s’affole. (The teacher sees a mouse. She panics.)
* Le footballeur marque un but. On l’acclame. (The soccer player scores a goal. He is applauded.)
* Le clown fait son numéro. On applaudit. (The clown does his act. People clap.)
* Isabelle voit du lilas. Elle en cueille. (Isabelle sees some lilacs. She picks some.)
* Fernand rentre du marché. Il est très tard. (Fernand comes back from the market. It is very late.)
* Les combats sont terminés. Tout est calme. (The combats are finished. Everything is calm.)
* Tous les agneaux sont perdus. Le loup rôde. (All the sheep are lost. The wolf prowls.)

APPENDIX 3: EXPERIMENTS 2A AND 2B

Test sentences
* Le voleur force les vitrines et il les brise. (The robber forces the windows and he breaks them open.)
* L’éléphant voit les clowns et il les asperge. (The elephant sees the clowns and he sprinkles them.)
* Le chasseur voit les éléphants et il les trompe. (The hunter sees the elephants and he misleads them.)
* Le professeur compte les élèves et il les classe. (The professor counts the students and he classifies them.)
* Le facteur prend les colis et il les livre. (The postman takes the packages and he delivers them.)
* Le bijoutier voit les bracelets et il les montre. (The jeweller sees the bracelets and he shows them.)
* Le concierge tire les volets et il les ferme. (The caretaker pulls the shutters and he closes them.)
* Le menuisier ponce les fenêtres et il les porte. (The carpenter pounds the windows and he carries them.)

* L’air remue les branches et il les brise. (The air stirs the branches and it breaks them.)
* Le jardinier sort les légumes et il les asperge.
(The gardener takes the vegetables out and he sprinkles them.)
* Le menteur voit les enfants et il les trompe.
(The liar sees the children and he tricks them.)
* Le collectionneur trie les timbres et il les classe.
(The collector sorts the stamps out and he classifies them.)
* L’instituteur prend les cahiers et il les livre.
(The instructor takes the workbooks and he delivers them.)
* Le magicien sort les cartes et il les montre.
(The magician sorts the cards out and he shows them.)
* Le paysan range les granges et il les ferme.
(The peasant tidies the barns up and he closes them.)
* L’esclave soulève les fardeaux et il les porte.
(The slave heaves the loads and he carries them.)

Buffer sentences

* Les passants voient un blessé et ils le soignent.
(The passers-by see a wounded man and they take care of him.)
* Les gens cherchent un enfant et ils le trouvent.
(The people look for a child and they find him.)
* Les soldats ont un prisonnier et ils le frappent.
(The soldiers have a prisoner and they hit him.)
* Les pirates ont un trésor et ils le surveillent.
(The pirates have a treasure and they look over it.)

* Les enfants font des paris et ils les gagnent.
(The children make a bet and they win it.)
* Les campeurs ont des journaux et ils les brûlent.
(The campers have some newspapers and they burn them.)
* Les caissiers prennent les billets et ils les rangent.
(The cashiers take the notes and they put them in order.)
* Les concurrents ont des pions et ils les bougent.
(The competitors have some pawns and they move them.)

* Le ramoneur range ses outils dans la caisse.
(The chimney-sweep arranges his tools in the case.)
* Le jeune pianiste a étonné l’assemblée.
(The young pianist astonished the audience.)
* Les gens sont imprudents car l’orage approche.
(The people are imprudent, as the storm is approaching.)
* La communication est un problème important.
(Communication is an important problem.)
* Les ingénieurs étudient les causes du drame.
(The engineers study the causes of the drama.)
* Les architectes sont réunis sur la place.
(The architects are assembled on the square.)
* Un projet de restructuration est à l’étude.
(A plan of reconstruction is being studied.)
* Les militaires contrôlent la situation.
(The military men control the situation.)
* La réussite économique est assurée.
  (Economic success is assured.)
* Les auditeurs déplorent la qualité du son.
  (The auditors deplore the quality of the sound.)
* Les infirmières bénévoles sont remarquables.
  (The voluntary nurses are remarkable.)
* La mode n’est plus seulement une question de prix.
  (Fashion is no longer only a matter of price.)
* L’écureuil saisit la noisette et rejoint l’arbre.
  (The squirrel gets the nut and goes back to the tree.)
* Tous les amis du poète étaient rassemblés.
  (All of the poet’s friends were assembled.)
* Les bon restaurants so trouvent à la périphérie.
  (The good restaurants are at the outskirts.)
* Le plongeur découvre des richesses insoupçonnées.
  (The diver discovers some unexpected wonders.)