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Running title: stress representation in French

Are prosodic variants stored in the French mental lexicon?

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4 **Abstract**
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9 A long-term priming experiment examined the way stress information is processed and
10 represented in French speakers' mind. Repeated prime and target words either matched (/bã'do/ -
11 /bã'do/ 'headband') or mismatched their stress pattern (/bãdo/ - /bã'do/). In comparison to a control
12 condition (/maʁʒ/ - /bã'do/), the results showed that matching and mismatching primes were
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equally effective in facilitating the processing of the target words. Thus, despite the fact that French speakers routinely produce and hear words in their stressed and unstressed versions, this study suggests that stress in French is not integrated into lexical representations.

Keywords: Spoken word recognition, lexical representations, French prosody, primary stress.

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4 *Regarde le joli la'pin!* 'Look at the pretty bunny' or *Regarde le lapin 'noir!* 'Look at the
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6 black bunny'. In French, a same word (e.g. *LAPIN* 'bunny') either receives primary stress or
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8 doesn't depending on its place within the accentual phrase. In particular, a word is stressed when
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10 it corresponds to the last full syllable of the accentual phrase. Consequently, French speakers
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12 continuously produce words in both their stressed and unstressed versions and are routinely
13
14 exposed to both versions in everyday conversational exchanges. How many *LAPIN* versions are
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16 stored in French speakers' minds? Are words stored in various prosodic forms in the French mental
17
18 lexicon? This is precisely the question under investigation. This is an important endeavor, because
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20 while studies have examined how French speakers perceive stress patterns that do not respect the
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22 stress placement rules in French (e.g. Dupoux, Pallier, Sebastián & Mehler, 1997), to the best of
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24 our knowledge, to this date, no study has examined the way French speakers represent allowed
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26 stress patterns in French.
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35 In a seminal study examining how French speakers perceive stress information, Dupoux et
36
37 al. (1997) reported that these speakers experience difficulties discriminating between stimuli that
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39 differ in the position of stress. In an ABX task, in which A, B and X were spoken by three different
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41 speakers, and in which participants judged whether X was identical to A or to B, Dupoux et al.
42
43 (1997) showed that compared to Spanish speakers, French speakers had more difficulties
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45 discriminating between two nonsense words that differed only in stress position (**'fidape**, fi'**dape**).
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47 In addition, French speakers performed worse when the stimuli differed in stress (**'fidape**, fi'**dape**)
48
49 than in phoneme (**'fidape**, **'lidape**). However, a more recent study (Michelas, Esteve-Gibert and
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51 Dufour, 2018) indicates that French speakers' difficulties in using stress information is specific to
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53 stimuli that do not respect stress placement rules in French. In Dupoux et al. (1997), first vs. second
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55 stressed syllables (**'fidape**, fi'**dape**) and second vs. third stressed syllables (fi'**dape**, fida'**pe**) were
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4 used, but in French, a word cannot receive primary stress at any non-final position. Using the same
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6 paradigm as Dupoux et al., Michelas et al. (2018) also showed that French speakers had more
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8 difficulty discriminating between two French words that differed in stress location (/ʒyʁi/-/ʒyʁi/)
9
10 compared to words that differed in one phoneme (/ʒyʁĩ/-/ʒyʁi/ ‘swearword-jury’). Crucially, no
11
12 difficulty was observed when the stimuli differed in the presence vs. absence of stress (/ʒyʁi/-
13
14 /ʒyʁi/), namely on a stress contrast frequently encountered in French. In this specific condition,
15
16 French speakers performed equally well on a stress (/ʒyʁi/-/ʒyʁi/) and on a phoneme (/ʒyʁĩ/-
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18 /ʒyʁi/) difference. Such observation suggests that French speakers are fully capable of
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20 discriminating an unstressed word from its stressed counterpart, but they experience difficulty
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22 establishing categories based on stress location probably because it does not exist in French.
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30 Other studies have shown that French speakers use the presence/absence of stress to
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32 segment continuous speech stream into words (Bagou & Frauenfelder, 2018; Christophe,
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34 Peperkamp, Pallier, Block, & Mehler, 2004; see also Spinelli, Welby & Schaegis, 2007; Spinelli,
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36 Grimault, Meunier & Welby, 2010 for secondary stress). Christophe et al. (2004), asked
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38 participants to detect a target word (e.g. *CHAT* ‘cat’) in sentences like [*Le CHAT grin'cheux*] ‘the
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40 grumpy cat’ in which only the word *grincheux* ‘grumpy’ is stressed or in sentences like [*Le*
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42 *'CHAT*] [*grim'pait*] ‘the cat was climbing up’ in which both the words *chat* and *grim'pait* are
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44 stressed. They found slower detection times in [*Le CHAT grin'cheux*] than in [*Le 'CHAT*]
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46 [*grim'pait*]. The slower detection of *CHAT* in [*Le CHAT grin'cheux*] has been interpreted as
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48 resulting from competition between *CHAT* and its competitor *chagrin* ‘sadness’. In this case, since
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50 there is no stress on *CHAT* to indicate its end, the word *chagrin* remains active and competes with
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52 the word *CHAT*. The results of Christophe et al.’s suggest that French speakers insert a word-final
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4 boundary each time they encounter a stressed syllable. It appears thus that the presence of stress in
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6 French boosts lexical segmentation by preventing the activation of inappropriate lexical candidates.
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10 Because French speakers use stress information both to categorize words as being stressed
11 or unstressed (Michelas et al., 2018) and to locate word boundaries, the question under
12 investigation in the current study is whether French speakers encode stress information in their
13 lexical representations. Indeed, since French speakers routinely produce and hear words in their
14 stressed and unstressed versions, models assuming the storage of multiple variants for a same word
15 either in an abstract way (Connine, Ranbom & Patterson, 2008) or in the form of detailed acoustic
16 traces (Goldinger, 1998) predict that words in French could be stored both in their stressed and
17 unstressed forms.
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21 We used the long-term priming paradigm which is a well-established procedure to probe
22 the functional architecture of the mental lexicon and processes involved in spoken word recognition
23 (Dufour & Nguyen, 2014; Dufour & Nguyen, 2017; McLennan & Luce, 2005; McLennan, Luce
24 & Charles-Luce, 2003; Monsell & Hirsh, 1998; Sumner & Samuel, 2009). Word repetition effects
25 as well as more subtle priming effects among phonologically similar words have been obtained
26 using this procedure. Here, we focused on the long-term repetition priming effect. Typically, in
27 this kind of paradigm, participants are presented with two blocks of stimuli, the first consisting of
28 the primes, and the second consisting of the targets. During the second block, some of the words
29 from the first block are repeated and the others consist in new words. The repetition priming effect
30 refers to facilitation in the processing – i.e. decrease in reaction times (RTs) – for the target words
31 encountered for a second time, and has been interpreted as being due to the repeated activation of
32 the same form-based representation in memory. Numerous studies have shown that the long-term
33 repetition priming effect is sensitive to both phonemic and subphonemic variation in the way words
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4 are pronounced due to, one the one hand, dialectal accent (Sumner & Samuel, 2009) and allophonic
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6 variation (McLennan et al., 2003), and on the other hand, to speaker identity (Dufour & Nguyen,
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8 2014; McLennan & Luce, 2005) and speech rate (McLennan & Luce, 2005). In their study,
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10 McLennan et al. (2003) focused on phonological variation in the way words are pronounced and
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12 examined how flap is processed and represented in memory. In American English when /t/ or /d/
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14 occurs between two vowels as in *butter* or *paddy*, they are realized as a flap (/r/), a segment that is
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16 neither /t/ nor /d/. In a lexical decision task, the authors reported a clear repetition priming effect,
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18 in comparison to a control condition, when the primes and targets were identical (e.g. [bʌrə]-
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20 [bʌrə]; [bʌtə]-[bʌtə]). No significant priming effect was observed when the primes and the targets
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22 mismatched ([bʌtə]-[bʌrə]) in the intervocalic segment realization. The lack of a priming effect
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24 when the prime was [bʌtə] and the target was [bʌrə] and vice versa suggested that two different
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26 lexical representations were activated by [bʌrə] and [bʌtə]. Sumner and Samuel (2009) examined
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28 the way phonological variation that comes from dialectal accent is processed and represented in
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30 NewYork city (NYC) dialect speakers who systematically produce an r-less variant of -er final
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32 words, but who are regularly exposed to General American (GA). The results of a long-term
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34 priming experiment showed that both GA final r-full primes (*slend*[ə]) and NYC final r-less primes
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36 (*slend*[ə]) facilitated responses to both GA final r-full targets (*slend*[ə]) and NYC final r-less
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38 targets (*slend*[ə]) in NYC dialect participants. Nonetheless, the magnitude of these facilitation
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40 priming effects was smaller than that observed in the case of repeated prime and target pairs (GA
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42 primes and targets and NYC primes and targets). Such observation suggests that *slend*[ə] only
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44 partially activated the lexical representation corresponding to *slend*[ə] and vice versa, and that two
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46 distinct lexical representations were fully activated by *slend*[ə] and *slend*[ə].
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58 Other studies using the long-term repetition priming paradigm have shown that more subtle
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60 variation in the way a particular word is pronounced, related to speaker identity or speech rate, also
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4 affects the way the spoken word is processed and represented (Dufour & Nguyen, 2014; McLennan
5 & Luce, 2005). In a lexical decision task in which non-words were wordlike, McLennan & Luce
6 (2005) manipulated speech rate in one experiment and speaker identity in another experiment.
7
8 Repeated prime and target words either matched or mismatched in speech rate or speaker identity.
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10 In comparison to unrelated prime-target pairs, both match and mismatch primes were effective in
11 facilitating the subsequent processing of the target words. Nonetheless, a significant difference
12 between match and mismatch primes, with slower RTs in the mismatch priming condition,
13 indicated that both types of prime were not equally effective in priming the target words. Such a
14 diminution in the magnitude of the repetition priming effect when repeated primes and targets were
15 pronounced by different speakers, was also reported for low-frequency words in Dufour and
16 Nguyen (2014).
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33 Altogether, the aforementioned studies indicate that the long-term priming paradigm is
34 well-suited to examine whether words are represented in the multiple forms they take. Based on
35 the logic behind the long-term repetition priming effect, we examined whether the regular
36 production and exposure to French words in both their stressed and unstressed forms have led to
37 the creation of distinct lexical representations. In our study, words were repeated either in the same
38 stress pattern (e.g., /bã'do/ - /bã'do/, *bandeau* 'headband') or in a different stress pattern /bãdo/ -
39 /bã'do/). We reasoned that if the different prosodic forms that French speakers produce are
40 represented distinctly in the mental lexicon, then the presentation of one variant would not fully
41 activate the other variant because there isn't an exact match between the information present in the
42 input of one variant and the lexical representation associated with the other variant. As a result, a
43 diminution in the magnitude of the repetition priming effect should be observed when the repeated
44 primes and targets mismatch on their stress pattern.
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Method

Participants: Forty-eight native speakers of French between 18 and 45 years old participated in the experiment. Each participant gave informed consent prior to the experiment. They all reported having no hearing or speech disorders.

Material: Forty-eight words with a CVCV disyllabic structure were selected from Lexique, a lexical database of the French language (New, Pallier, Ferrand, Matos, 2001) and were used both as primes and targets. They have a mean frequency of 7.60 occurrences per million. 16 additional words with the same syllabic structure were selected and used as control primes. They have a mean frequency of 6.96 occurrences per million. The words are given in Appendix 1.

In order to obtain the stressed and unstressed versions of the stimuli, we asked a native speaker of French to produce the 64 words within carrier sentences in which the target word bore stress on its last syllable or was unstressed depending on its position within the Accentual Phrase (AP) (e.g. *On m'avait parlé [d'un bandeau 'bleu]_{AP} qui était joli* 'I had been told about a blue headband which was pretty' vs. *On m'avait parlé [d'un petit ban'deau]_{AP} qui était joli* 'I had been told about a small headband which was pretty'). To avoid coarticulation effects due to contextualized-speech, each word was first extracted from its carrier sentence and then auditorily presented to the speaker in isolation. The speaker had to repeat each word in its stressed and unstressed versions. The 128 tokens thus obtained were recorded at a sampling frequency of 44 100 Hz, segmented and then normalized in intensity at a level of 70 dB SPL.

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4 Acoustic analyses were then conducted using Praat software (Boersma & Weenink, 2015)
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6 to ensure that the words were produced with the expected stress patterns. Pre-boundary lengthening
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8 and fundamental frequency (f0) rises, the two main correlates of primary stress in French, were
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10 measured and are summarized in Table 1. Since our words were CV/CV disyllabic words, the
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12 boundary between both syllables was hand-located at the end of the first vowel inspecting both
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14 waveforms and spectrograms. f0 minima and maxima associated to the two syllables were located
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16 using Praat commands. Note that in order to minimize microprosodic effects due to voiceless gaps,
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18 the words were selected so that the two syllables began with a voiced consonant. Duration and f0
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20 values were then automatically extracted using Praat scripts. As expected, the final syllable of the
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22 target words was longer ($t(47) = 17.73, p < .0001$) and associated with a stronger f0 rise ($t(47) =$
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24 $21.26, p < .0001$) than the first syllable only in their stressed versions. The average duration of the
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26 target words was 381 and 287 ms, respectively in their stressed and unstressed versions. Figure 1
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28 illustrates the word *bandeau* ‘headband’ produced in its unstressed version [bãdo] then with a
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30 primary stress on its last syllable [bã'do].
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42 INSERT TABLE 1 AND FIGURE 1
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47 For the purpose of the lexical decision task, 64 disyllabic pseudo-words with a CVCV
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49 structure were created by changing the last phoneme of real words not previously used (e.g. /bezi/
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51 created from the word /beze/ ‘kiss’). This allowed us to have wordlike non-words, and to constrain
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53 the participants to listen to the stimuli up to the end prior to giving their response. The non-words
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55 followed the same criteria as the words and were thus recorded and produced in their stressed (e.g.
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57 /be'zi/) and unstressed (e.g. /bezi/) versions.
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7 Design: Two blocks of stimuli were presented. The first one consisted of the primes and the
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9 second one of the targets. Within each block, half the stimuli were stressed, and the other half were
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11 unstressed. The target block consisted of 48 target words and 48 pseudo-words. Among the 48
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13 target words, 16 served in the matched priming condition, 16 in the mismatched priming condition
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15 and 16 in the control priming condition. Within each priming condition, half the target words were
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17 presented in their stressed version, and the other half were presented in their unstressed version.
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19 The prime block also consisted in 48 words and 48 pseudo-words. Among the prime words, 16
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21 consisted in the repetition of the targets with the same stress pattern (e.g. /bã'do/ - /bã'do/), 16
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23 consisted in the repetition of the targets with a different stress pattern (e.g. /bãdo/ - /bã'do/), and
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25 the 16 others were the control primes and were unrelated to the targets. Among the control primes,
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27 half of them were presented in their stressed version and the other half were presented in their
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29 unstressed version. As for the pseudo-words, 16 consisted in the exact repetition (with the same
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31 stress pattern) of the pseudo-words used in the target block, 16 consisted in the repetition of the
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33 pseudo-words used in the target block but with a different stress pattern, and 16 were unrelated.
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43 Because each target word was paired with three different primes (match, mismatch, control)
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45 and no participant was presented with the same target twice, three experimental lists were created.
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47 The three lists were then divided into two sub-lists so that each stimulus of the prime and target
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49 blocks was heard in its stressed and unstressed versions.
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55 Procedure: The participants were tested individually in a sound attenuated booth, and the
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57 stimuli were presented over calibrated headphones at 70 dB. Stimulus presentation and recording
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59 of the data were controlled by a PC running the E-Prime software (version 2.0, Psychology
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4 Software Tools). In both the prime and the target blocks, participants were asked to make a lexical
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6 decision as quickly and accurately as possible with “word” responses using their dominant hand
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8 on a button-box that was placed in front of them. Response times (RTs) were recorded from the
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10 onset of stimuli. Within each block, the stimuli were presented randomly. An inter-trial of 2000 ms
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12 elapsed between the participant's response and the presentation of the next stimulus. The
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14 participants were tested on only one experimental list and they began with 12 practice trials.
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23 **Results and discussion**

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28 Data are available at the Open Resources and Tools for Language (ORTOLANG)
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30 repository: https://hdl.handle.net/11403/expepsycho_michelasdufour. Statistical analyses were
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32 performed on the target words. Four items that gave rise to an error rate of more than 40% were
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34 removed from the analyses. RTs analysis was performed on correct responses, thus removing 228
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36 data (10.8%) out of 2112 data. 6 outliers (one RT = 372 ms and the other five > 2000 ms) were
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38 also excluded from the analysis. The mean RT and percentage of correct responses in each
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40 condition are presented in Figure 2. RTs were analyzed using a linear mixed-effect regression
41
42 model (lme4 package in R-studio statistics Version 1.1.456). For the model to meet the
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44 assumptions of normally-distributed residuals and homogeneity of the variance, a log
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46 transformation was applied to RTs. The model was run on 1878 data points. The model included
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48 prime type (match, mismatch, control) as fixed effect, participants and items as random intercepts
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50 and random slopes by participant and by item.
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With the control prime condition as intercept, the model revealed that RTs were faster for target words preceded by match primes than for target words preceded by control primes ($\beta = -0.09$, $SE = 0.01$, $t = -7.44$, $p < .0001$). RTs were also faster for target words preceded by mismatch primes than for target words preceded by control primes ($\beta = -0.09$, $SE = 0.01$, $t = -6.54$, $p < .0001$). To test the difference between the match and the mismatch conditions, the model was relevelled so that the match prime condition was the intercept. Critically, no difference was observed between the match and mismatch prime conditions ($\beta = 0.01$, $SE = 0.01$, $t = 0.45$, $p > .20$).

Accuracy data (1 = correct responses, 0 = incorrect responses) was analyzed using a mixed-effect regression model with a logistic linking function. The model was run on 2112 data points. It included prime type (match, mismatch, control) as fixed effect, participants and items as random intercepts and random slopes by participant and by item. With the control prime condition as intercept, the model revealed that participants gave more correct responses for target words preceded by match primes than for target words preceded by control primes ($\beta = -1.04$, $SE = 0.28$, $z = -3.70$, $p < .001$). Participants also gave more correct responses for target words preceded by mismatch primes than for target words preceded by control primes ($\beta = -1.00$, $SE = 0.24$, $z = -4.14$, $p < .0001$). To test the difference between the match and the mismatch conditions, the model was relevelled so that the match prime condition became the intercept. Critically, no difference was observed between the match and mismatch prime conditions ($\beta = 0.04$, $SE = 0.30$, $z = 0.12$, $p > .20$).

To sum-up, our study suggests that match and mismatch primes were equally effective in facilitating the processing of the target words. A possibility, however, is that the long-term priming

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4 paradigm is not sensitive enough to detect a difference in the size of the priming effect across match
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6 and mismatch conditions. Despite substantial studies suggesting that it is rather unlikely (Dufour
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8 & Nguyen, 2014; McLennan et al., 2003; McLennan & Luce, 2005; Sumner and Samuel, 2009),
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10 we ran a control experiment to provide further demonstration that this paradigm is well-suited to
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12 probe the activation of different lexical representations. This control experiment focused on another
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14 type of variation, and in particular on segmental variation coming from regional accents. In
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16 Southern French, there is no contrastive distinction between /o/ and /ɔ/ (e.g. *côte* ‘hill’ /kot/ vs. *cote*
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18 ‘rating’ /kɔt/ in Standard French), and Southern French is said to have one back mid vowel
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20 phoneme only, whose phonetic realization as a mid-high [o] or mid-low [ɔ] is entirely governed by
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22 the structure of the carrier syllable: it is mid-high in open syllables and mid-low in closed syllables.
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24 As a result, the word *mauve* “mauve” pronounced [mov] by Standard French speakers is
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26 pronounced [mɔv] by Southern French speakers. Because Southern French speakers are regularly
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28 exposed to Standard French pronunciations via the media and/or interactions with speakers of other
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30 French areas, some studies (Dufour, Nguyen & Frauenfelder, 2007; Dufour, Chuang & Nguyen,
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32 2019) suggest that these speakers are likely to have created two lexical representations for the
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34 words *mauve*, the one corresponding to the Standard French variant (/mov/), and the other one
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36 corresponding to their own variant (/mɔv/). Thus, in this control experiment using exactly the same
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38 procedure as in the main experiment, we tested whether the magnitude of the long-term repetition
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40 priming effect modulates as a function of a segmental mismatch between two lexical forms.
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42 Because regional variation is not the focus of the present paper, the experiment is described in
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44 Appendix 2. Overall, the results revealed a significant difference between the match (/mɔv/-/mɔv/)
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46 and mismatch conditions (/mov/-/mɔv/). Thus, our failure to find a significant difference between
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48 the match and mismatch primes in the main experiment is probably not due to a lack of sensitivity
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50 of the paradigm. Rather, the null effect between the match and mismatch primes is probably due
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to the fact that it is the same form-based representations that have been activated by the two prosodic variants.

General discussion

In the French language, the presence of stress within words has no consequence for their meaning. However, French speakers routinely produce and encounter words either in their unstressed version (/bãdo/) or in their stressed version (/bã'do/) according to their place within the accentual phrase. Given that stress in French guides lexical segmentation (Bagou & Frauenfelder, 2018; Christophe et al., 2004), we examined here whether or not stress information influences spoken word recognition. We found a clear repetition priming effect both when the repeated primes and targets matched and when they mismatched in their stress patterns. More crucially, match and mismatch primes were equally effective in facilitating target word processing. Such an observation thus suggests that the same form-based lexical representation associated to the target words has been activated by both match and mismatch primes. More importantly, despite the fact that French speakers routinely produce and hear words in their stressed and unstressed versions, this study suggests that stress in French is not integrated into lexical representations.

Our findings thus argue in favor of the storage of only one lexical representation for the multiple prosodic variants that French words take. On the contrary, our control experiment as well as other studies examining the representation and processing of regional variants (Dufour et al., 2019; Sumner & Samuel, 2009) or the schwa vowel (Connine et al., 2008) clearly support the view of a mental lexicon composed of multiple variants for a word (Connine et al., 2008). For example, Connine et al. (2008) examined the way American listeners recognize words containing the schwa vowel deletion in post-stress environment (*corporate* vs. *corp'rate*). Participants had to perform a lexical decision task on both with-schwa and without-schwa versions of words while variant production frequency was manipulated (high deletion rate/low deletion rate). For without-schwa

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4 variants, participants responded faster for words with high deletion rate than for words with low
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6 deletion rate. The authors concluded that the two variants of the word *corporate*, the one with the
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8 schwa vowel and the other one without the schwa vowel are stored in the mental lexicon of
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10 American English listeners with their respective frequency. These results suggest that the different
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12 pronunciations of a word lead to the creation of multiple lexical representations, the one
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14 corresponding to the /'kɔ:rpərət/ form and the other corresponding to the 'kɔ:rpɪrət/ form. A
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16 way to reconcile multiple variants storage modeling with our findings related to prosodic variants
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18 is to consider that lexical representations rely more on segmental than supra-segmental
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20 information. As a result, stress variation could be encoded in the lexical representations only when
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22 it is lexically contrastive (e.g. Soto-Faraco, Sebastián-Gallés & Cutler, 2001 for Spanish). Since
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24 stress information is not lexically distinctive in French, we cannot bring support to this class of
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26 models when we focus on stress variation.
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There is however substantial evidence that lexically-irrelevant acoustic cues, related for example to speaker identity or speaking rate, are encoded along with phonological information, and affect spoken word recognition (Dufour & Nguyen, 2014; McLennan & Luce, 2005). The integration of lexically-irrelevant information is possible within exemplar-based models of spoken word recognition (Goldinger, 1998; Hintzman, 1986). Such models offer a view of the mental lexicon consisting in multiple acoustic traces that encode perceptual and contextual details associated to each individual occurrence of a word. Word recognition consists in finding the nearest match in this vast collection of exemplars. Because in these models each word is associated with multiple acoustic traces encoding fined-grained acoustic information, and because French words are associated to both a lengthening of their last syllable and a typical f0 rise when they are stressed, variation in stress pattern could be encoded in the same way as related-speaker variation has been

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4 shown to be encoded. However, stress in French is only cued by two main acoustic cues
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6 (lengthening of the syllable, and f0 rise). One possibility is that the cues signalling the presence vs.
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8 absence of stress in French are not as acoustically salient as speaker information such as gender
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10 differences which are cued by a large set of acoustic indices (e.g., f0 mean, f0 range, vocalic
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12 duration, VOT, formants, breathiness). Consequently, stress cues in French don't get mapped onto
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14 lexical representations and play no role in spoken word recognition. However, as we have seen,
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16 the cues signalling the presence vs. absence of stress are successfully used by French speakers in
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18 lexical segmentation tasks (Christophe et al., 2004) as well as in discrimination tasks (Michelas et
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20 al., 2018), thus making less likely that the lack of salience of stress cues is responsible of the fact
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22 that they are not coded in the lexicon. Therefore, our study examining the use of acoustic cues other
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24 than those related to speaker specificities poses some problems for exemplar-based models of
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26 spoken word recognition, and constitutes a new challenge for this kind of framework which has to
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28 explain why some sort of acoustic variants are stored and others not.
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37 In conclusion, our study suggests that all word forms that speakers routinely produce and
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39 hear are not necessarily stored in the mental lexicon and used during word recognition. Our study
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41 also points out that it is not because listeners use certain cues present in the speech signal to perform
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43 one task (e.g. ABX task) that they necessarily use these cues to perform another task (e.g. lexical
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45 decision). Therefore, the ability of listeners to use speech cues thus needs to be tested through a
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47 wide variety of tasks.
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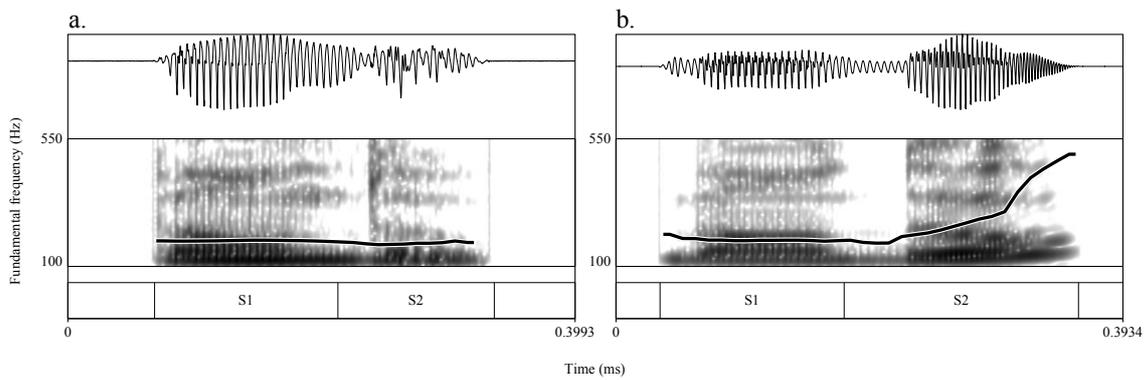
Table 1. Acoustic characteristics of target words in their stressed and unstressed versions.

	Unstressed version		Stressed version	
	1 st syllable	2 nd syllable	1 st syllable	2 nd syllable
Syllable duration (ms)	144	143	142	239
f0 minimum* (Hz)	187	176	182	171
f0 maximum* (Hz)	181	174	178	402
f0 rise (%)	-3	-1	-2	136

* For unstressed syllables, the minimum and maximum f0 values correspond to the values associated to the beginning and the end of the f0 plateau.

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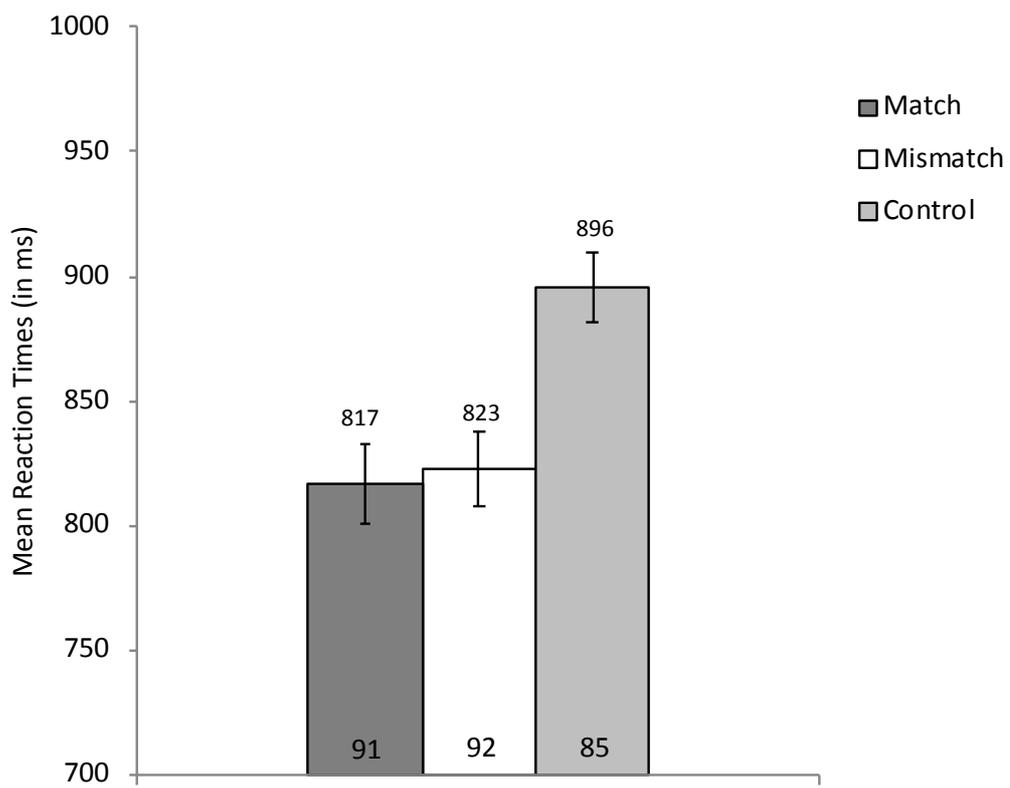
Figure 1. Phonemic and prosodic profile of the target word /bãdo/ ‘headband’ in its unstressed (a) and stressed (b) version.



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Figure 2. Mean Reaction Times (in ms) and Standard Errors as a function of prime type.

Percentage of correct responses is shown below the bar for each condition.



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5 **Appendix 1:** Control primes and target words used in the experiment.
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9	Control primes	Target words	Target words continuation
10	baron	bambou	lilas
11	bijou	diva	morue
12	gamin	gala	radis
13	guenon	levain	roumain
14	jambon	mamie	renvoi
15	jumeau	menu	rouleau
16	melon	robot	bourreau
17	rubis	vallon	dindon
18	bilan	bonbon	goujat
19	boudin	donjon	moulin
20	garant	juron	nounou
21	jeudi	lundi	ravin
22	marron	museau	verrou
23	relent	remou	
24	mairie	renom	
25	roseau	vomi	
26		bandeau	
27		devis	
28		landau	
29		magie	
30		magot	
31		rabbin	
32		regain	
33		venin	
34		bison	
35		goulot	
36		logis	
37		malin	
38		nougat	
39		rameau	
40		raisin	
41		visa	
42		boulon	
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4 Appendix 2: Method and results of the control experiment.
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9 **Method**
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12 Participants: Thirty-six native speakers of French between 18 and 45 years old participated
13 in the experiment. Each participant gave informed consent prior to the experiment. They all
14 reported having no hearing or speech disorders. After running the experiment, we ensured through
15 a reading task that all the participants pronounced the mid back rounded vowel as /ɔ/ in closed
16 syllables, as expected in the Southern French variety.
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21 Material: Forty-two target words, whose /o/ vowel is pronounced [ɔ] by Southern French
22 speakers and [o] by Standard French speakers, were selected from Lexique (New et al., 2001) and
23 were used both as primes and targets. Among the 42 target words, 14 were monosyllabic (e.g.
24 mauve /mov/ ‘mauve’) and 28 were disyllabic with the critical vowel occurring on the last syllable
25 (e.g. fantôme /fãtom/ ‘ghost’). They had a mean frequency of 8.17 occurrences per million. 14
26 additional words of the same syllabic structure than the target words were selected and used as
27 control primes. They had a mean frequency of 8.21 occurrences per million.
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46 For the purpose of the lexical decision task, 56 pseudo-words with the same syllabic
47 structure as the words were created by changing the last phoneme of real words not previously used
48 (e.g. /gamim/ created from the word /gamin/ ‘young girl’).
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56 A trained phonetician produced the 42 critical target words (e.g. mauve) in both their
57 Standard (e.g. /mov/) and Southern (e.g. /mɔv/) French forms. All of the stimuli were recorded in
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4 a sound-attenuated room, digitized at a sampling frequency of 44 100 Hz, segmented and then
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6 normalized in intensity at a level of 70 dB SPL. The mean duration of the target words was 684 ms
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8 and 678 ms respectively in their Standard and Southern forms. The mean duration of the control
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10 words was 685 ms.
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16 Design: Two blocks of stimuli were presented. The first consisted of the primes and the
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18 second of the targets. The target block consisted of 42 target words and 42 pseudo-words. Among
19
20 the 42 target words, 14 served in the matched priming condition, 14 in the mismatched priming
21
22 condition and 14 in the control priming condition. Half the target words were presented in their
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24 Standard form, and the other half were presented in their Southern form. The prime block also
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26 consisted of 42 words and 42 pseudo-words. Among the prime words, 14 consisted in the repetition
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28 of the targets with the same /o/ variant (e.g. /mɔv/ - /mɔv/), 14 consisted in the repetition of the
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30 targets with the different /o/ variant (e.g. /mov/ - /mɔv/), and the other 14 were the control primes
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32 and were unrelated to the targets.
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41 Because each target word was paired with three different primes (match, mismatch, control)
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43 and no participant was presented with the same target twice, three experimental lists were created.
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45 The three lists were then divided into two sub-lists so that the /o/ words in the prime and target
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47 blocks were heard both in their Standard and Southern French versions.
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53 Procedure: It was the same as in the main experiment.
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Results and discussion

Statistical analyses were performed on the target words. One item that gave rise to an error rate of more than 40% was removed from the analyses. RTs analysis was performed on correct responses, thus removing 59 data (4%) out of 1476 data. 3 outliers (RTs > 2500 ms) were also excluded from the analysis. The mean RT and percentage of correct responses in each condition are presented in Figure 3. RTs were analyzed using a linear mixed-effect regression model, and a log transformation was applied to them. The model was run on 1414 data points. The model included prime type (match, mismatch, control) as fixed effect, participants and items as random intercepts and random slopes by participant and by item.

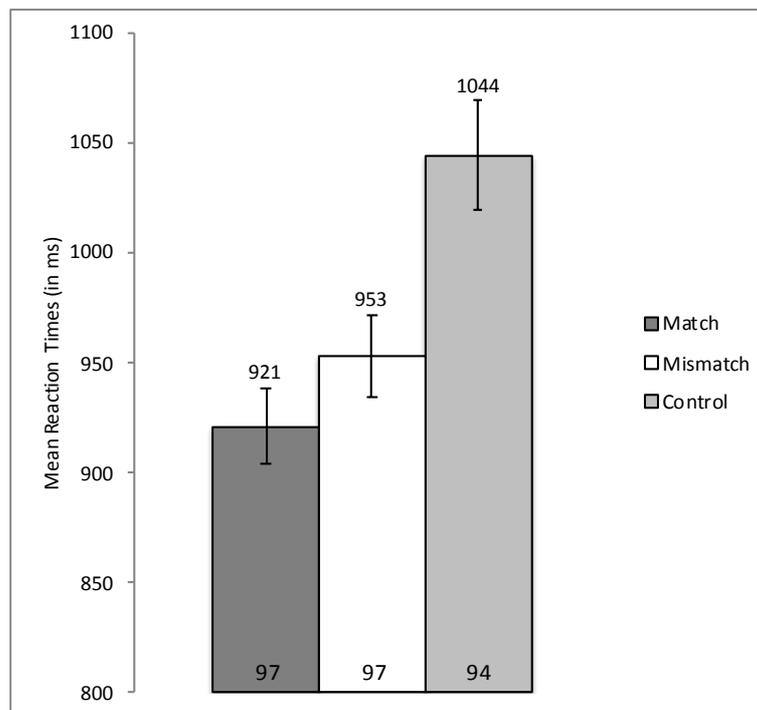
With the control prime condition as intercept, the model revealed that RTs were faster for target words preceded by match primes than for target words preceded by control primes ($\beta = -0.12$, SE = 0.02, $t = -6.38$, $p < .0001$). RTs were also faster for target words preceded by mismatch primes than for target words preceded by control primes ($\beta = -0.09$, SE = 0.01, $t = -6.15$, $p < .0001$). To test the difference between the match and the mismatch conditions, the model was relevelled so that the match prime condition became the intercept. Crucially, a significant difference was observed between the match and mismatch prime conditions ($\beta = 0.03$, SE = 0.01, $t = 2.10$, $p < .05$), with RTs longer in the mismatch condition.

Accuracy data (1 = correct responses, 0 = incorrect responses) was analyzed using a mixed-effect regression model with a logistic linking function. The model was run on 1476 data points. It

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included prime type (match, mismatch, control) as fixed effect, participants and items as random intercepts and random slopes by participant and by item. No significant effect was found.

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4 Figure 3. Mean Reaction Times (in ms) and Standard Errors as a function of prime type. Percentage
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6 of correct responses is shown below the bar for each condition.
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4 **Control primes and target words used in the control experiment**
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9	Control prime	Target words	Target words continuation
10	enclume	arôme	dose
11	charade	atome	fraude
12	clinique	embauche	gaufre
13	crapule	apôtre	glauque
14	dinette	icône	sauce
15	fissure	binôme	crawl
16	perruque	fantôme	coach
17	textile	guimauve	piaule
18	tunnel	morose	
19	bassine	neurone	
20	claque	pylône	
21	greffe	aumône	
22	douane	hypnose	
23	perle	ozone	
24		contrôle	
25		fibrome	
26		cirrhose	
27		cyclone	
28		diplôme	
29		glucose	
30		névrose	
31		psychose	
32		royaume	
33		symptôme	
34		syndrome	
35		thermos	
36		sclérose	
37		scoliose	
38		chauve	
39		daube	
40		fauve	
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