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## Rime and syllabic effects in phonological priming between French spoken words

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### ABSTRACT

Phonological priming between spoken words was examined using CVCVC bisyllabic pseudoword primes and word or pseudoword targets. The influence of different types of overlap was compared, prime and target sharing the coda, the rime or the final syllable. The task was *target shadowing*. Two priming conditions were used, the auditory targets being preceded by auditory primes in unimodal and by visual primes in crossmodal situation. Priming effects were obtained under unimodal stimulation only. A strong facilitation occurred with syllable overlap while a smaller facilitation was found with rime overlap. Coda overlap produced no effect. The absence of effect in crossmodal stimulation argues that the final overlap effects occur before the semantic system. Concerning the underlying units, a comparison of our results with those obtained from CCVC monosyllables with overlaps in phonemic length similar to those we used, suggests that both rime and syllabic units per se are involved in the effects of final similarity between spoken words.

### 1. INTRODUCTION

The involvement of the syllable in the processing of speech in French has already been demonstrated in several paradigms: in sequence detection and phoneme monitoring ([1], [2], [3]), and in phonological migrations ([4]). For our part, we addressed the question of the syllabic involvement in French speech processing using phonological priming. This paradigm is based on the idea that processing a stimulus – called prime – should affect the processing of a subsequent stimulus – called target – if prime and target share some formal phonological information which coincides with a unit involved in the access to the lexicon. Due to the original version of the Cohort theory ([5]) which gave a special status to word

onsets, most of the formal auditory priming studies were concerned with the role of initial phonological overlap (*sad* - *sack*, for examples). Although effects going in radically different directions – from facilitation to inhibition – or, more often, no effect at all were reported ([6], for a review), several studies in which the probability of strategic effects was low, converged to show inhibitory priming effects between monosyllabic items sharing at least the three initial phonemes ([7], [8], [9]).

In contrast, final overlap (*back* – *lack*, for ex.) has consistently produced facilitation in lexical decision as well as in shadowing ([10], [11], in English; [12], [13], in Dutch; [8], [6], in French). This effect was shown to disappear under auditory prime - visual target crossmodal stimulation and was found insensitive to prime lexicality ([6]). Moreover, Radeau ([8]) suggested that it might involve rime units because using CCVC monosyllabic items she observed facilitation only when prime and target shared at least the last two phonemes [VC], and no increase of this facilitation for one additional phoneme overlap [CVC]. However, the rime nature of the underlying units has been inferred from monosyllabic items only. It was therefore impossible to know if a larger unit like the syllable might be involved in the final phonological overlap effect.

So, our investigation aimed first at specifying the units underlying the final overlap effect between plurisyllabic items in French and, more particularly, to assess the role of the syllable - syllabic effects have already been demonstrated in this language.

Secondly, we wanted to confirm the absence of priming effect under crossmodal visual-auditory stimulation, i.e., in conditions opposite to those used by Radeau et al. ([6]).

Finally, we tried to determine how the final overlap effect occurred. According to Radeau et al. ([6]), the function of the units activated by the final information in the prime might be to take part in the lexical selection of the target when the target cohort is activated. If it is the case, no effect should be expected on pseudoword targets.

## 2. EXPERIMENT

To achieve the first goal, we examined the influence of primes of CVCVC phonological structure sharing the coda (*fucède*, for ex.) [sound A1019S01.wav], the rime (*fupide*) [sound A1019S02.wav], the syllable (*fulide*) [sound A1019S03.wav] or no phoneme (*fucère*) [sound A1019S04.wav] with their target (*bolide*). If the final overlap effect depends on phonemic units, we should expect a relatively linear increase in the effects with the growing number of shared phonemes (syll. > rime > coda > contrôle). If the effect involves rime units exclusively, equal facilitation should be obtained for rime and syllable but not for coda overlap (syll. = rime > coda = ctr.). Finally, if the effect derives exclusively from syllabic units, only syllable overlap should give rise to facilitation (syll. > rime = coda = ctr.). To achieve our second goal, we used two conditions of prime presentation (auditory vs. visual, between-subject factor), the target being always auditorily presented. We used only pseudoword primes. However, we varied the target lexical status in order to test whether such a priming effect occurs during the target selection phase.

Two x 48 participants were tested on 160 experimental trials, the proportion of related trials being of 24 %. The experimental task was *target shadowing*, in which the subjects repeated the target as quickly and accurately as possible. In the crossmodal situation, the subject's attention to the visual primes was controlled by an unreadable prime detection secondary task (*b\$ts\$ge*, for ex.). So as to make

both situations of stimulation comparable, a 20 ms ISI was used in the unimodal condition while a 800 ms SOA corresponding to the mean auditory length of the primes was used in the crossmodal one, the visual prime being presented during 600 ms followed by a 200 ms blank. Reaction time from target onset and error rate were measured as dependent variables.

## 3. RESULTS

A - A Unimodal Stimulation <sup>(1)</sup>							
Prime	Word targets						
	ctrl.	coda	rime	syll.	Control vs		
					coda	rime	syll.
RT (ms)	749	744	721	698	5	28 *	51 **
Error %	0.8	0.7	0.5	0.6	0.1	0.3	0.2
Prime	Pseudoword targets						
	ctrl.	coda	rime	syll.	Control vs		
					coda	rime	syll.
RT (ms)	778	774	765	749	4	13 *	29 **
Error %	3.8	3.5	3	3	0.3	0.8	0.8

V - A Crossmodal Stimulation <sup>(2)</sup>							
Prime	Word targets						
	ctrl.	coda	rime	syll.	Control vs		
					coda	rime	syll.
RT (ms)	709	709	699	699	0	10	10
Error %	0.8	1	1.5	1	-0.2	-0.6	-0.2
Prime	Pseudoword targets						
	ctrl.	coda	rime	syll.	Control vs		
					coda	rime	syll.
RT (ms)	736	736	735	740	0	1	-4
Error %	4.4	4.4	3.4	3.4	0	0.9	0.9

Tables 1 and 2. Mean RTs, error rates and priming effects in each condition according to the modality of stimulation; (\*\*) indicates effects statistically significant by subject & item; (\*) indicates effects statistically significant by subject.

The RT analyses (ANOVAS by subject and item) revealed a clear interaction between the overlap effects and the modality of stimulation

( $p < .025$ ), the priming effects being restricted to the unimodal condition ( $p < .0001$ ). Hence, the effects of final overlap appear not to transfer under visual-auditory crossmodal stimulation either.

In the unimodal condition, the RT analyses showed a strong facilitatory effect of syllable overlap ( $p < .0001$ ), and a smaller effect of rime overlap only significant by subject ( $p < .0001$ ). Coda overlap gave rise to no effect. Thus, rime and syllable overlaps seem to underlie, differentially however, the effect of final phonological similarity (syll. > rime > coda = ctr.). Moreover, both rime and syllable overlap effects tended to be stronger for word than for pseudoword targets. However, this interaction was only significant by subject ( $p < .0025$ ) and therefore could not be generalized. Thus the effects not only occurred for word but also for pseudoword targets.

#### 4. DISCUSSION

The logic underlying the comparison between the effects obtained under unimodal vs. crossmodal stimulation is based on neuropsychological ([14]; for a review) and positron emission tomography data ([15], [16]) which suggest that written and spoken words would be processed by separate and modality-specific analysis systems and input formal lexicons before accessing a higher-level common amodal semantic system. In this theoretical framework, the dependence of the final phonological overlap effect on the auditory input modality supports the view that such an effect arises before the semantic system. This result is quite logical given that the effect was shown to be insensitive to prime lexicality ([6]) and in fact would hence take place even before the phonological input lexicon.

With regard to how final overlap phonological priming occurs, the effects on pseudoword targets is somewhat difficult to explain if we admit that the only function of the units activated by the final information in the prime is to participate in the target selection when the target initial information has just been

processed. If a single mechanism is responsible for final overlap effects, it cannot be the involvement in the target lexical selection.

Concerning the underlying units, we cannot say that our strong effect of CVC syllable overlap involves syllabic units unless we compare this effect to that produced by a CVC overlap in phonemic length similar to ours but which is not matched with a final syllable. In fact, using CCVC items Radeau ([8]) tested a CVC overlap which corresponded to no particular structure except that it included the rime. In contrast to our priming effect, such a non-syllabic overlap produced only an effect equal to that of the rime. Thus, a CVC overlap matched with a syllable gave rise to a greater effect than that of the rime while a CVC overlap not matched with a syllable did not. The comparison of our results with those of Radeau ([8]) leads therefore to the view that the effect of the final syllable overlap involves indeed both rime and syllabic units per se.

In sum, the priming by final phonological overlap in French seem to result from the prelexical activation of rime and syllabic units which may well contribute to the lexical selection phase.

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