Visual word recognition of morphologically complex words: Effects of prime word and root frequency

Hélène Giraudo
Laboratoire CLLE (Equipe ERSS)
CNRS & Université Toulouse Jean Jaurès
giraudo@univ-tlse2.fr

Karla Orihuela
Laboratoire CLLE (Equipe ERSS)
CNRS & Université Toulouse Jean Jaurès
karla.orihueal@univ-tlse2.fr

Abstract

The present study aims to investigate the relative role of the surface frequencies (i.e., token frequencies) in base word recognition. A masked priming experiment was carried using two types of suffixed French primes: the effects of words having a surface frequency (SF) higher than their base (e.g., *cigarette* – *cigare*) were compared with those produced by word primes having a SF lower than their base (e.g., *froideur-froid* 'coldness-cold'). Results show that HighSF are more efficient primes than LowSF relative to both orthographic and unrelated priming baselines. This suggests that despite a highly salient base, whole words matter more than morphemes during the early processes of lexical access.

1 Introduction

Morphological complexity has been extensively explored by psycholinguists in order to shed light on the role of morphology in lexical structuring. Starting from the idea - inherited from the connectionist theory of visual word recognition (see Seidenberg, 1987) - that the lexicon is comprised of different levels of interconnected representations reflecting the linguistics characteristics of the words as well as the cognitive processes by the which complex words are recognized, the main issue regarding lexical morphology concerns its specific role relative to word forms and semantics. Accordingly, morphology can be though as a structuring factor either for the lexicon, morphological relationships being expressed by the mapping between from and meaning reflecting the construction of the words (e.g., Giraudo & Voga, 2007; 2014; Giraudo & Grainger, 2000; 2001; but see also Aronoff, 1994 and Booij, 2010 for the same linguistic view) or for the access ways to the lexicon, morphology influencing the simple development of orthographic representations (e.g., Duñabeitia et al., 2007; Rastle & Davis, 2003; Rastle et al., 2004 and see in the same vein Marantz, 2013). An interesting way to explore this issue is to use the masked priming paradigm (Forster & Davis, 1984) which has been designed to measure the qualitative and the quantitative effects induced by the prior processing of a morphologically complex word presented visually on the subsequent processing of another -target- word. Behavioural data obtained with the masked priming paradigm associated with the lexical decision task revealed clear strong morphological priming effects through various languages (Arabic: Boudelaa & Marslen-Wilson, 2001; Basque: Duñabeitia, Laka, Perea, & Carreiras, 2009; English: Rastle, Davis, Marslen-Wilson & Tyler, 2000; French: Giraudo & Grainger, 2000; German and Dutch: Drews and Zwitserlood, 1995; Greek: Voga & Grainger, 2004; Hebrew: Frost, Deutsch & Forster, 1997) but the results are still controversial when manipulating the relative frequencies of the prime and the target. On the one hand, some studies (Giraudo & Grainger, 2000) have revealed that larger effects are obtained when using high in comparison to low frequency derived primes encouraging the lexeme-based approach; on the other, some authors (McCormick, Rastle, & Davis, 2009) have failed to observe an interaction between the prime frequency and morphological facilitation, strengthening the morpheme-based approach. It has been suggested that these outcomes may be due to the fact that the methodological procedure among experiments varies (Amenta & Crepaldi, 2012), as they each use a

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different timing for their stimulus onset asynchrony (SOA). The SOAs of the original experiments were of 57ms in Giraudo and Grainger (2000) and 42ms in McCormick, Rastle, & Davis (2009).

2 The study

In order to disentangle such findings, the present study was carried out using the same paradigm and similar SOAs as the previous ones described. The main manipulation was to compare morphological facilitation when the frequency of the complex words (used as primes) and their roots (used as targets) was inverted. More specifically we selected 60 base word targets from French, half having systematically a surface frequency higher than their derived forms (55.82 occ./million) and the other half a surface frequency lower than their derived forms (10.15 occ./million according to *Lexique* database, New, Pallier, & Ferrand, 2001). Each target was primed by (1) a morphologically related word (M, e.g., *mariage-marier 'wedding – to marry'*), (2) an orthographically related word (O, e.g., *marine-marier, 'navy-marry'*) and (3) an unrelated word (U, e.g., *courage-marier, 'courage-marry'*). In both the HighSF condition and the LowSF condition, primes were matched in number of letters (respectively 6.4 and 7 letters in average) and surface frequency (respectively 6.48 and 40.64 occ./million in average). Primes were presented according to two frame durations (SOAs), 48 and 66ms to examine the time-course of priming. Three experimental lists were constructed using a Latin square in order to present each target once only.

Twenty-five students at the University of Toulouse participated in the experiment. All the participants were native speakers of French and their average age was 26 (7.23 sd). They were all right handed and had normal to corrected-to-normal vision. The experiment lasted around 40 minutes and in exchange for their time, participants received a 4 Giga USB key.

The results are presented in Table 1. As we didn't find any effect of the frame duration, we decided to present the averaged RTs.

Mistaken answers were not considered for the statistical analysis (2.8% of the data), neither were reaction times lower than 250ms and over 1500ms (1% of the data). Cut-offs for the rest of the data were set to 2.5 standard deviations from general average and outliers were removed (1.4%).

Table 1: mean reaction times across the three priming conditions and the two targets conditions. Net priming effects are expressed in ms.

		RTs	Net priming effects (U-M/O-M and U-O)
HighSF primes-LowSF targets	M primes	613	+45* / + 36*
	O primes	649	+9
	U primes	658	
LowSF primes-HighSF targets	M primes	572	+22 / +18
	O primes	590	+4
	U primes	594	

* : $p < .05$

The results show a clear pattern of a morphological facilitation effect (reaction times decreases when the prime-target relationship is morphological, compared to orthographic and unrelated control conditions).

A significant difference across conditions can be observed only when the target word has a lower frequency than the primes. Statistical analysis showed that the critical net priming effects (difference between the reaction times for morphological primes against orthographic and unrelated control ones) for HighSF primes - LowSF targets was of 45* and 36*ms (respectively).

When looking at the LowSF-primes and HighFs targets the RTs differences of the net priming effects previously described, where not statistically significant Morphological facilitation effects seem to be larger when the frequency of the prime is higher than the frequency of the target, regardless of the SOA used.

2. Conclusion

The results of the present study are in line with the previously found by Giraudo and Grainger (2000), showing differential priming effects when the surface frequency of the prime is manipulated. The absence of a morphological priming effect in the High frequency M-primes/Low frequency targets contrasted with the strong sig-

nificant priming effects obtained with the Low frequency M-primes/High frequency targets, suggests competition effects to the detriment of an obligatory decomposition process. According to this view both low and high frequency targets should have benefit from the prior presentation of a morphologically related word, but the results revealed this was not the case. Only base targets having a surface frequency lower than the surface frequency of their derivation were significantly facilitated relative to both the orthographic and the unrelated conditions (+45 and +36ms). We interpret these data as an evidence of a competition process among the word forms at the word level.

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