# Visual word recognition and morphological processing: Evidence from European Portuguese

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## Introduction

In a large number of natural languages, many words are formed by more than one morphological constituent: the presence of a root is compulsory, inflectional specifiers are also quite frequent; derivational affixes or other roots occur in complex words.

There is wide evidence that derivational morphology plays an important role for the processing of complex words (Rastle & Davis, 2008 for a review), but what representational architecture lies behind these morphological effects is a question that remains open to debate.

There are a number of relevant data showing that children's ability to manipulate the internal structure of words is a condition that is directly related to the capabilities of reading (Carlisle, 1995; Carlisle & Nomanbhoy , 1993; Deacon & Kirby, 2004; Fowler & Liberman, 1995; Kirby, Deacon, Bowers, Izenberg, Wade-Woodley & Parrila). However, there are still many issues to be deciphered, such as when and how young readers process the complex words while reading, what are the lexical representations sustaining cognitive operations to word recognition.

In the case of Portuguese – language with a rich morphology – the existence of abundant complex morphological words allows us to inquire on how morphological knowledge may interfere with the process of reading, when this knowledge impact o n the online VWR .

## Materials and methods

We tested children attending the fourth grade (N=68) using a masked *priming* paradigm. The task performed was a lexical decision task: readers had to read and decide whether if the word read was a possible word in European Portuguese or a non word.

Two nominalization suffixes where chosen and tested because of their productivity in EP:

one denominal *(-eiro)*  cartaN -> cart*eiro*N

other deverbal *(-dor).*  nadarV -> nada*dor*N

We used 3 conditions for the experiment:

(i)    morphologically related words

MR - ***mineiro*/*carteiro***  (*miner  / postman*);

(ii) morphological overlapped words

MO - ***mineiro*/*poleiro*** (*miner / perch*);

(iii) morphologically unrelated words

MU - ***mineiro*/*caneta*** (*miner  / pen*)**.**

We divide de sample in two groups: the first one (N=36) saw the prime for 50 ms and the rest saw the prime for 150 ms.

The participants were previously assessed for both oral and reading language to outwit any disturbance.

## Results

We start our analysis by replacing some deviant outliers: all values above 2,5 standard deviation were replaced by the value of mean plus 2,5 standard deviation. 1,23% of reaction times were replaced in the group exposed to the prime for 50 ms; while in the group exposed  for 150 ms, the changed values increased for 2,66%. We performed an ANOVA test, for both exposition times. Results showed significant differences between the 3 morphological (un)related conditions. In order to understand which condition produced more effects, we applied  t-student test. The results are displayed in graphic 1, and tables 1 and 2.

### REACTION TIMES



Graphic 1 – Reaction Times for 150 ms presentation

| Condition | t | df | Sig |
|---|---|---|---|
| MR vs MO | 0,233 | 430 | 0,816 |
| MR vs M.U | 2,535 | 430 | 0,012* |
| MO vs. M.U | 2,278 | 430 | 0,023* |
| MR+MO vs. M.U | 2,646 | 648 | 0,008* |

Table 1 – Results for 50 ms prime presentation

| Condition | t | df | Sig |
|---|---|---|---|
| MR vs MO | 3,011 | 111 | 0,003* |
| MR vs M.U | 1,271 | 112 | 0,206 |
| MO vs. M.U | -1,926 | 111 | 0,052 |
| MR+MO vs. M.U | -0,04 | 167 | 0,968 |

Table 2 – Results for 150 ms prime presentation

## Discussion/Conclusions

The results indicate that morphological information exert its effects in the early and latter stages of word processing, but the effects found are different considering the relation between the words. In the early stages children can establish the difference between a morphological related word in opposite to a unrelated word and between an apparently related word in opposite to a unrelated word. In the latter stages of recognition, children can establish the difference between a real morphological related word and an apparently related word.

Contrary to what would be expected, in both groups, the reaction time to morphological related words was higher than that for morphological unrelated words. This results suggest that there was no prime effect when the words had the same suffix. Our hypothesis was that by seeing the prime, the subjects activate the word internal structure, benefiting the analyses of the base form and the suffix. Logically, this increases the reaction time for complex words processing. In the case of apparently related words, reaction times were lower precisely because there is no decomposition of the target, but we still need to assume that there is a recognition of the pseudo suffix, since processing takes longer than for unrelated words. In unrelated words, reaction times were lower probably because the access to the words was direct.

When we analyse the results obtained at 50 ms, we found significance between the reaction times obtain for morphological related words and morphological unrelated words. We also found differences in access to morphological overlapped words and morphological unrelated words. However, we did not find any significant difference in the access to morphologically related words and morphologically overlap words. The results didn't show any effect of morphology, but show differences between the access of words that are and seem morphologically related and words that are not related with the prime in morphological terms.

In the case of 150 ms presentation, the results show significant differences between the access to morphologically related words and morphologically overlap words. This results are opposite the ones found in the 50 ms experiment. The longer prime time exposition cancelled every effect of the prime-target relation previously found and show difference in the access of words that have a morphological relation and words that seams to have a relation.

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