

ROLE OF THE GRAMMATICAL GENDER IN MENTAL LEXICON ACCESS

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ABSTRACT

The aim of the present study is to evaluate the effect of the grammatical gender in word recognition for French. The focus is on auditory word identification when words are presented within a restricted context, *i.e.* preceded only by the French definite article, singular: "le/la". In this particular context one may hypothesize that this syntactic information could be considered as a prime for accessing the mental lexicon.

INTRODUCTION

Spoken language comprehension is a process of high complexity involving a great number of different processing levels. Among these levels, there is one of particular importance: the level of word identification and recognition. Lexical recognition relies on the mapping of information extracted from the verbal stimulus with a particular representation present in the mental lexicon. Consequently, word recognition consists in accessing the mental lexicon in which representations of the constituents of a given language are stored in long term memory for all speakers of the language.

Models have been elaborated in order to describe the internal mental access process. A good amount of these models posit that recognition of an acoustic element is based on two types of information: acoustic-phonetic information furnished by the input itself and information present in the context of the input. Generally, recognition of words presented auditorily is triggered by acoustic-phonetic information, also called bottom-up information; context-

tual or top-down information intervene later. Such models, in particular the Cohort model — whose first version was elaborated by Marslen-Wilson and Welsh, based on Morton's model of Logogenes and on Forster's model — aim at accounting for lexical recognition processes regardless of language specificity. However, languages have different organizational structures. Cutler and colleagues [1] have demonstrated that French and English subjects behave differently in segmenting verbal units when recognizing them and that this difference in behaviour is linked to the structure of the language. From such results, it is judicious to think that the relevance of contextual information used in the process of internal lexicon access, depends, to a certain degree, on the structural organization specific to the language. Thus information furnished by the context would be used differently depending on particular linguistic structures of languages which consequently would develop their own routines in the word recognition process [1]. So, one would state that in languages where gender is part of their lexical organization, this linguistic specificity should play a critical role in the mental lexicon access process. The purpose of the gender in a language is to arrange referential elements (nouns and pronouns) into lexical classes according to the formal characteristics encountered by these elements in a sentence. All lexical classes have a particular characteristic or *trait de genre* (gender feature). According to Renault [2] this gender feature does not appear in the lexical unit but in a unit associated with

it. In Romance languages, the gender feature is represented by an element that precedes the lexical base, *i.e.* the determinant. From a psycholinguistic point of view, one may wonder to what extent does this contextual element influence access to the internal lexicon in a language such as French? Apart from Grosjean *et al.* [3], studies in this area are very rare, even though the gender in French is omnipresent: there is no substantive that does not possess the masculine or the feminine gender [4]. To bring some light to this question, we decided to study the role of the grammatical gender in structuring the internal lexicon and its influence as contextual information carried by the singular definite article, masculine or feminine (le/la), on the word recognition process. This problem will be addressed experimentally using lexical decision or related paradigms.

EXPERIMENTS

Experiment 1: lexical decision task

This experiment consisted of two tests comparing lexical decision for isolated words and non-words to lexical decision for words and non-words preceded by the French singular definite article "le/la". According to previous studies [5] [6] a faster lexical decision for items preceded by an article was expected.

Method:

Subjects: 19 native French speakers, all students participated in this experiment. Materials: two different lists of 160 stimuli each were constructed. In each list, the words were mixed in equal number with non-words and presented in random order. All targets in the two lists were separated by a three second silence.

Procedure: The two lists were presented in random order and instructions were given between each list. Subjects were asked to answer as fast and as accurately as possible by pressing a decision-key.

Results: Errors and Reaction-Times (RTs) for correct responses were analy-

sed. As RTs were measured from the onset of each item — in order to compare decision time in the two conditions — the article mean duration value ("la"=137 ms ; "le"=144 ms) was subtracted from mean decision time to the sequences "article + real word" and "article + non-word". A three-way ANOVA on mean RTs with factors *condition*, *target type* and *gender* showed a significant main effect of *condition* $F(1,128) = 16,992$ $p = .0001$. There was no interaction effect between *condition*, *target type* and *gender*. This means that, a target preceded by the article is recognized faster than a target in isolation. However, would such a priming effect, related to the syntactic information carried by the article, reflect a specific organization of the internal lexicon? To answer this question we elaborated a second experiment.

Experiment 2: gender decision task

This experiment concerned real isolated words: 80 masculine words and 80 feminine ones mixed in a list. The task was to determine the grammatical gender of the targets by pressing a button "masculine" or "feminine".

If the mental lexicon is organized according to word grammatical gender, the gender decision would be performed within the time of lexical decision for isolated lexical items. If the noun grammatical gender is explicitly marked in the mental lexicon, then the gender decision would be longer than the lexical decision for isolated words.

Method: The method is similar to those of the first experiment.

Results: We compared RTs of the sequences "article + real words" (with the article duration mean value subtracted) of the second list of the first experiment with RTs obtained in this experiment. A three-way ANOVA on mean RTs taking *condition*, *target type* and *gender* as the variables showed a significant effect of *condition* $F(1,140) = 24,888$ $p = .0001$. The word recognition task is faster than the gender identification one. According to this result, it can be supposed that

mental representations would be ordered in the mental lexicon according to explicit marks. Consequently the grammatical gender decision would be post-lexical. In order to verify this hypothesis a third experiment was designed.

Experiment 3: compatibility decision task

160 "article + word" stimuli were used: for 80 out of them the gender of the article did not correspond to that of the following word (e.g. *le maison instead of "la maison"). This decision task consisted in deciding if in a noun phrase the gender of the article was compatible with the grammatical gender of the following word.

If grammatical gender figures in the mental lexicon, one might suppose that compatibility decision would occur at the same time with lexical decision as regards sequences "article + real word".

Method: the method is similar to that of the two preceding experiments.

Results: Only sequences "article + real words" of the second list in the first experiment and the gender compatible sequences "article + real word" of this experiment were used. Analyses of variance with three factors (*target type*; *condition and gender*) showed a significant effect of *condition* $F(1,140) = 17,42$ $p = .0001$. So compatibility decision is significantly longer than lexical decision.

DISCUSSION AND CONCLUSION

The various results obtained in the three experiments support the claim that the gender plays an active role both in the mental lexicon access and in its organization.

According to results from the first list of the first experiment it is suggested that the processing of a phonological string is the same whether it belongs to the lexicon or not. There is no significant difference in RTs between recognizing an isolated word or an isolated non-word (RTs words = 929 ms; RTs non-words = 1016 ms). Compared to normal verbal communication, in which

all elements emitted are supposedly endowed with meaning and would thus help in the recognition of subsequent units, in the first experimental condition there was no contextual cues that may facilitate word recognition process. Thus subjects developed a strategy different from those used in everyday communication. Maximum acoustic-phonetic information to make decision about the stimuli was collected. So words and non-words in isolation are recognized well after their uniqueness point [7] and their deviation point [8] respectively. When such results are analyzed within the Cohort II model [9], it could be suggested that decisions about isolated units can only be made after perfect matching (in the case of real words) between the acoustic input and a mental representation.

Results obtained for real words in the two tests of the first experiment show that the presence of a gender element before the word, significantly influences the process of internal lexical access by accelerating it (RTs for words of list n°1 = 929 ms; RTs for words of list n°2 = 803 ms). According to Marslen-Wilson [9], in the Cohort II model, top-down information, *i.e.* contextual information, would have facilitating effects on lexical access. Facilitating effects would correspond to an increase in activation level of certain candidates compared with others. In this perspective, it can be supposed that the role of the definite article as contextual information, would be that of increasing the activation level for candidates of the initial cohort that share the same gender as that of the definite article. This selective activation would contribute in reducing the number of potential candidates that would fit the context and thus reduce the time needed for lexical recognition. In the case of isolated words, there are no contextual cues that may reduce the initial cohort.

Results from the gender decision task suggest that gender decision is post-lexical as it occurs later compared with the time needed for the recognition of a

word preceded by the definite article (RTs for words in experiment n°2 = 927 ms; RTs for words in list n°2 = 803 ms). Consequently one may conclude that access to word gender can be operational only when word access has applied. Thus the strategy used by subjects is not only that of an acoustic-phonetic analysis of the input but more so that of an active search in the lexicon. Such a lexical strategy is strongly influenced by the nature of the task: subjects knew that they only had to deal with words.

Compatibility decision is more complex than lexical decision. RTs obtained in the third experiment are significantly longer (1049 ms) than RTs concerning word recognition in context (943 ms). Such results can be accounted for within the Cohort II model. From the task required of subjects, they knew that the article and the word could sometimes be incompatible in gender. It follows that the influence of the context, *i.e.* of the definite article, was neutralized by the experimental paradigm. Not a single representation present in the initial cohort could have an activation level higher than an other with regards to its gender, since the input article may not correspond to the word that follows. Thus the effect of the grammatical gender is no longer absolute but rather more *probabilistic* [3].

Following these findings, one may posit that the grammatical gender intervenes in the structure of the mental lexicon by ordering representations in relation to their gender. The mental lexicon would thus resemble a dictionary, solely composed of words accompanied by their gender marking. If such is the structure of the internal French lexicon it can be hypothesized that the organization of the mental lexicon is not universal but specific to the language it belongs to. From such a perspective, access processes would not be universal but determined by the structural characteristics of every language.

To carry out a more thorough analysis of this hypothesis, it should be worthwhile examining the mental lexicon

access for languages that have a grammatical gender resembling that of the French language, but also for those that have other types of gender.

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