AN APPROACH TO THE INFLUENCE OF CONTEXT IN THE RECOGNITION OF SPOKEN FRENCH WORD

*S. Monpiou, **M.N. Metz-Lutz, *F. Wioland
*Institut de Phonétique de Strasbourg - Université Marc Bloch
22 rue Descartes, 67084 Strasbourg, France
**INSERM U398
Hôpitaux Universitaires de Strasbourg - Clinique Neurologique
67091 Strasbourg, France

ABSTRACT
This study examines the extent to which word recognition is influenced by the information of grammatical gender given by the French singular definite article (le/la). More specifically, the focus is on auditory word recognition when words are in the final noun phrase in a Subject Verb Object (SVO) sentence. We compared the gender effect with that of the semantic information of the verb in order to estimate its importance.

1. INTRODUCTION
In everyday communication, words are always in context, that is they are always uttered with other words, with certain exceptions in particular situations (order, exclamation, etc.). Several studies had evidenced the role of information provided by the sentence context in the process of word recognition [1]. But, as Swinney (1979) [2] underlined it, the true question does not concern the possible effect of the context on this process, but really the locus of this effect in the lexical recognition process.

An other question concerns the type of information that intervenes in the lexical recognition. A lot of studies in this domain were essentially conducted in English. However, the contextual information available for lexical recognition in this language is not the same as in other languages. Thus the relevance of contextual information used by the spoken-word recognition process is addressed. Some studies by Cutler and colleagues [3] have shown that French and English subjects do not react similarly when segmenting the speech wave. And this different behaviour is directly in relation with the structure of each language. So it is judicious to suppose that the information taken into account differ and depend, to a certain degree, on the specific linguistic structure of a language.

In this study, we propose to analyze the effect of a particular contextual information: the grammatical gender explicited by the French definite article, singular (le/la). Only few studies examined the role of this information in the recognition of words [4], [5], [6], [7]. They all demonstrated that the information of gender plays a role in lexical access. In French, all nouns have a gender (masculine or feminine) [8], which is largely determined by the singular determinant [9]. According to our previous results [10], [11], [12], we know that in a restricted context, that is the context of the noun phrase (for example: la chemise), the grammatical gender influences the process of word recognition by enhancing it.

The purpose of the study is to test this grammatical gender influence when the noun is in a more extensive context that is the Subject Verb Object (SVO) sentence. We hypothesize that in this context the gender still exerts its influence on the spoken-word recognition process. In order to evaluate this influence, that is to locate it in the recognition process, we compare the grammatical gender effect to that of the semantic information of the verb. Indeed, number of studies have shown that the conceptual verbal semantic information is post-lexical [13], [14]. So the comparison would provide indications about the action of the grammatical gender in lexical recognition. The study is conducted using a lexical decision task.

2. METHOD
2.1. Material
In order to test the effect of the grammatical gender, we elaborated 12 different SVO sentences (example: Elle lave la chemise). Following Friederici and colleagues [15], in each of these 12 sentences we modified the information given by the article and by the verb. We thus obtained the 7 different following conditions:

• Normal Condition: In this condition, the gender of the definite article is congruent with the gender of the following noun.
Example: Elle lave la chemise

• Normal-2 Condition: In this condition, the gender of the indefinite article is congruent with the gender of the following noun.
Example: Elle lave une chemise

• Neutral Condition: In this condition, the information of gender is absent.
Example: Elle lave les chemises

• G-incongruent Condition: In this condition, the gender of the definite article is incongruent with the gender of the following noun.
Example: *Elle lave le chemise
• **V-incongruent Condition:** In this condition, the semantic information of the verb is incongruent with the following noun.
Example: *Elle lit la chemise*

• **Double violation Condition:** In this condition, both the gender of the definite article and the semantic information of the verb are incongruent with the following noun.
Example: *Elle lit le chemise*

• **Non-word Condition:** In this condition, the final element of the sentence is a non-word.
Example: *Elle lit le [Rakad]*

Finally, the test is composed of 144 sentences, which are separated in 4 blocks of 36 sentence context. The decision is on the final element of these sentences.

2.2. Subjects

Three groups of subjects performed the task:
• one group of 28 voluntary students (14 females and 14 males). All were native French speakers (mean age: 25:2).
• one group of 7 children aged 7:3 to 8:1, which corresponds to the Cours Elémentaire 1 (CE1) level of primary school.
• one group of 9 children aged 10:4 to 11:3, which corresponds to the Cours Moyen 2 (CM2) level of primary school.

2.3. Procedure

All the subjects performed the task in the sound proof room at the Institut de Phonétique de Strasbourg.

3. RESULTS

Errors and Reaction-Times (Rts) for correct responses were analysed for each group of subjects. However, we did not take into account the statistic results of the youngest children. Indeed, because of the limited number of subjects in this group and because of the heterogeneity of the data due to their age, the statistic analysis is not relevant.

Errors rates are summarized in table 1 and means Rts are presented in table 2.

<table>
<thead>
<tr>
<th>Conditions</th>
<th>Adults</th>
<th>CM2</th>
<th>CE1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Word</td>
<td>0.4</td>
<td>1.4</td>
<td>2</td>
</tr>
<tr>
<td>Normal</td>
<td>0.3</td>
<td>0.9</td>
<td>3.6</td>
</tr>
<tr>
<td>Normal-2</td>
<td>0.3</td>
<td>0</td>
<td>4.8</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.3</td>
<td>0.9</td>
<td>4.8</td>
</tr>
<tr>
<td>G-incongruent</td>
<td>3.6</td>
<td>6.5</td>
<td>7.1</td>
</tr>
<tr>
<td>V-incongruent</td>
<td>1.2</td>
<td>6.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Double violation</td>
<td>13.1</td>
<td>13.9</td>
<td>22.6</td>
</tr>
</tbody>
</table>

Table 1. Errors rates (%) by condition

In the group of adults, a one-way analysis of variance (ANOVA) on mean Rts shows a highly significant effect of the factor «condition types» (p<.0001). In the group of children of CM2, no similar effect had been displayed.

Due to few data available in each condition, Rts were analysed with the non-parametric test of Wilcoxon. Within the group of adults, the statistic analysis of Rts showed a significant effect of the grammatical gender in the lexical recognition process. When a noun is preceded by the wrong gender mark (i.e. *le chemise* instead of *la chemise*), the recognition of that word is highly disturbed: between the 2 conditions «Normal» and «G-incongruent» there is both a significant increase of the time needed to perform the decision (p=.0001) and a significant increase of false decision (p=.0117). However, this gender effect should be taken with care. There is no significant difference between Rts of the 2 conditions «Normal» and «Neutral». Moreover, the number of errors in these conditions are the same. Consequently, the adults’ results only show an inhibition effect not correlated with a facilitation effect. The comparison of Rts in one hand, and the comparison of errors in the other hand, between the 2 conditions «G-incongruent» and «V-incongruent» are both significant (respectively: p=.0041 and p=.0499). A semantic violation in the verb phrase between the verb and its object produces an increase of the time needed to recognize the word. On the contrary, a morphosyntactic violation in the noun phrase of the verb phrase only produces an increase of errors of lexical judgments. So, these 2 types of contextual information seem to act in different ways.

Similarly to the adults, the comparison of mean Rts between the 2 conditions «Normal» and «G-incongruent» shows a significant effect of the gender information within the group of children of CM2 (p=0.152). When the article is not compatible in gender with the following noun, subjects take significantly more time to perform the task. But, as opposed to adults, a small gender effect between the conditions «Normal» and «Neutral» has been displayed (p=0.05). An explicit gender mark seems to be used by the lexical treatment process in order to enhance recognition: Rts are lower in the «Normal» condition than
in the «Neutral» condition. But the gender information plays no role on the accuracy of the responses: the number of errors is the same in these 2 conditions.

Within children of CM2, the comparison of mean Rts between conditions «G-incongruent» and «V-incongruent» is not significant. Mean Rts in these conditions are almost the same, which seems to reflect the same behaviour.

Within the youngest children we can only observe more sensitivity to the verbal semantic information. Regardless of the non-word condition, it is in the «V-incongruent» and «Double violation» conditions that the children responded the slowest and performed the most errors in lexical judgments. So, we can suppose that it is the sentence’s meaning that is the more important to these children. This observation corroborates the hypothesis of Bramaud di Boucheron (1981) [16] on the pre-eminence of the sentence semantic representation for the young child.

4. DISCUSSION AND CONCLUSION

The results of adults and of the children of CM2 show a gender influence in the lexical recognition process. The unique inhibitory effect displayed in the adults’ group does not invalidate the importance of that particular information in spoken-word recognition. Moreover, the apparition of that inhibitory effect could be explained in different ways. One must actually examine the validity of the «Neutral» condition which could have biaized the subject’s behaviour [17]. This inhibitory effect could also be explained by the experimental task. Indeed, it has been demonstrated that the lexical decision task is more sensitive to inhibitory effects than other tasks [18].

However, our results are in favor of the influence of the grammatical gender in word recognition processes. Statistical analysis show that adults responded more rapidly in the «G-incongruent» condition than in the «V-incongruent» one. We propose to interpret the result of the «V-incongruent» condition as a consequence of a controlled process as opposed to the result of the «G-incongruent» condition that could be the consequence of an automatic process. The number of errors in the «G-incongruent» condition suggests that the gender information is unlikely to be controlled by the system. This information seems to be used automatically from the onset of the recognition process. In contrast, the number of errors in the «V-incongruent» condition seems to point out that the decision performed by the adults does not concern the lexical status of the final element of the sentence, but the semantic coherence of the sentence. Consequently, the semantic information of the verb should be post-lexical and the gender information should be pre-lexical.

In conclusion, our results are in favor of a gender information participation in the lexical recognition process. Therefore, we suggest that the language processing procedures could be specific to languages. These procedures may be implemented according to the structural information available in a language. So it could be judicious to analyse more precisely the influence of specific linguistic information in order to bring some precisions about the lexical recognition processes. The general question underlying these analyses is to know if such processes follow a common schema for all languages or are they rather language specific.

ACKNOWLEDGMENTS

Sincere gratitude is extended to Rudolph Sock for his valuable help.

REFERENCES