The effects of syntactic complexity and working memory capacity on gender processing in L2 French: a self-paced reading experiment

The effect of the syntactic complexity of sentences on L2 processing has mainly been shown in subject vs. object relative clauses (e.g. [10], [6], [4]). More precisely, object relative clauses take more time to be processed than subject relative clauses. With respect to gender agreement constructions, the effect of syntactic complexity has only been demonstrated in offline studies on L2 production (e.g. [2], [1]). More specifically, gender agreement constructions hosted in relatively large syntactic configurations (and therefore taken as more complex [8]), trigger more production errors than those in smaller syntactic configurations [2]. However, no studies have been dedicated to the potential effect of syntactic complexity on the processing of gender agreement constructions in L2.

The role of the working memory (WM) capacity of L2 learners in sentence processing has also been investigated as a potential explanation for individual variation (e.g. [9], [5], [4], [3]). However, no consistent results have been found in recent L2 literature. [9] and [5] for instance, found a significant correlation between WM capacity and L2 sentence processing, while [4] and [3] did not.

The aim of this experiment is to provide new insights into the potential effect of syntactic complexity on the processing of gender agreement constructions in L2. New insights into the potential role of WM capacity in L2 sentence processing will also be provided.

In this study we tested Dutch learners of French (n = 37; B1/B2 level) by means of a forward/backward digit span task (as WM task) and a self-paced reading task focusing on the processing of gender agreement in adjectives. These adjectives were hosted in three types of agreement constructions differing in level of syntactic complexity: noun-adjective constructions (*Je pense que la robe _verte_ est vendue* 'I think the _red_ dress is sold'), predicative adjective constructions (*La famille est _importante_ pour Claude et moi* 'Family is _important_ for Claude and me') and adjectives in relative clauses (*Vivian porte une jupe qui est _grise_ et jaune* 'Vivian wears a skirt which is _grey_ and yellow'). A total of 90 stimuli consisted of 25 stimuli per type of agreement construction and 15 filler items. The adjective of each stimulus was in a feminine singular context and agreed with an inanimate noun. The gender of the noun was morphologically expressed by the article. Furthermore, the selected adjectives were matched for frequency and consisted of 1 to 3 syllables. None of the adjectives were in a sentence-initial or sentence-final position. Each stimulus consisted of 6 to 8 words in total.

The participant was presented each stimulus word-by-word on a Linux laptop. The next word appeared on the screen by clicking on a button box. Before the test stimuli started, a set of three practice items were presented. After a random set of stimuli a comprehension question popped up to make sure that participants paid attention to the task. The presentation order of stimuli was counterbalanced for each participant.

In each stimulus the reading time (in milliseconds) of the adjective segment and the segment preceding the adjective (*est*) in predicative adjective constructions and adjectives in relative clauses was measured. The measurement of the latter segment was a check to be sure that the effect of syntactic complexity on the processing of gender agreement was measured.

The reading times on the adjective were analysed by means of a Friedman's ANOVA. Post-hoc comparisons were made by means of Wilcoxon tests. The analysis revealed a main effect for Syntactic Complexity on the adjective ($X^2(2) = 14.00$; $p = .001$). Wilcoxon tests revealed that the reading time of adjectives in noun-adjective constructions is higher than that in adjectives in relative clauses ($T = 609$; $p < .001$; $r = .45$). Furthermore, the reading time of adjectives in predicative adjective constructions is higher than that in adjectives in relative

clauses ($T = 102$; $p < .001$; $r = -.44$). However, no significant difference between the reading time of adjectives in noun-adjective constructions and predicative adjective constructions has been found ($T = 294$; $p = .39$; $r = -.10$). To analyse the reading time of the segment *est* a Wilcoxon test was run. This test did not reveal a significant difference between the reading time of *est* in predicative adjective constructions and in relative clauses ($T = 233$; $p = .074$; $r = -.21$). To investigate the role of WM capacity in the processing of adjectives, correlation tests between the scores of the WM task and the reading times on the adjective were run for each type of construction. These tests did not reveal any correlation between WM capacity and reading times: noun-adjective constructions and WM ($r = -.23$; $p = .169$), predicative adjective constructions and WM ($r = -.20$; $p = .249$), adjectives in relative clauses and WM ($r = -.20$; $p = .244$).

The results show that the syntactic complexity of agreement constructions has an effect on the processing of gender agreement in L2 French. More precisely, the processing of gender agreement in relative clauses is faster than in noun-adjective and predicative adjective constructions. This finding is in line with offline data ([2], [1]) demonstrating that gender agreement in complex sentences trigger more production errors. Since the processing of complex sentences is cognitively more demanding, fewer resources remain for the processing of other linguistic information such as gender inflection (cf. [7]). We conclude that the effect of syntactic complexity on the L2 production of gender inflection can be explained by the level of processing costs involved in the processing of gender agreement. The absence of an effect of syntactic complexity on the processing of *est* demonstrated that the significant effect of syntactic complexity on the processing of adjectives is related to gender agreement. The fact that the processing of adjectives in noun-adjective and predicative adjective constructions did not significantly differ, suggests that the effect of syntactic complexity on L2 processing might only be related to the presence vs. absence of embedded clauses ([cf. [2] for similar results in offline data). Furthermore, we conclude that WM does not have an effect on written sentence processing in L2 (in line with [4] and [3]).

References
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