# ERP evidence for flexibility in accessing representations associated with subject-verb agreement



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200 400 600 800 1000 1200 ms

400 600 800 1000 1200 ms



#### Introduction

Previous studies in agreement processing, particularly subject-verb agreement, showed that abstract representations, such as grammatical agreement features, are being accessed (e.g., Mancini et al., 2011; Nevins et al., 2007; Osterhout & Mobley, 1995). Interestingly, our previous study (Aristia & Brunellière, 2017) also showed that associative representations (Seidenberg & MacDonald, 1999), which are related to the statistical regularity of language, are accessed during agreement processing. In subject-verb agreement processing, we define associative representations as the co-occurrence frequency between a pronoun and its inflection.

AIM OF THE STUDY: To know if there is a flexibility in accessing both representations associated with subject-verb agreement

APPROACH OF THE STUDY: We manipulated the task in two ERP experiments with grammatical priming procedure (Experiment 1, lexical decision task; Experiment 2, noun categorization task).

#### Methods

#### **Participants**

Experiment 1, 23 participants (18 females), 18-30 y.o.; Experiment 2, 24 participants (17 females), 19-25 y.o. All of them were right handed and had no auditory, language, nor neurological disorders.

Stimuli: 264 pronoun-verb pairs for critical stimuli (20% incongruent pairs of the total stimuli)

726 fillers (article-noun pairs, pronoun-verb pairs, pronoun-pseudoword pairs, and article-pseudoword pairs, 30% of the total stimuli for noun targets and for pseudoword targets)

Experimental factors in the critical stimuli:

- Associative frequency (i.e., high and low)
- Type of grammatical conditions (i.e., congruent, person violation, number violation, number & person violation)

Congruent condition	Type of violation	Incongruent condition
Tu montreras (2 <sup>nd</sup> person, singular)	Person	Je montreras /mɔ̃tвəка/ (je = 1 <sup>st</sup> person, singular)
Nous montrerons (1st person, plural)	Person	Vous montrerons /mɔ̃tʁəʁɔ̃/ (Vous = 2 <sup>nd</sup> person, plural)
Tu montreras (2 <sup>nd</sup> person, singular)	Number	Vous montreras /mɔ̃tвəва/ (Vous = 2 <sup>nd</sup> person, plural)
Nous montrerons (1st person, plural)	Number	Je montrerons /mวีtหอหวี/ (je = 1 <sup>st</sup> person, singular)
Tu montreras (2 <sup>nd</sup> person, singular)	Person & number	Nous montreras /mɔ̃tвəва/ (Nous = 1 <sup>st</sup> person, plural)
Nous montrerons (1 <sup>st</sup> person, plural)	Person & number	Tu montrerons /mɔ̃tвəвɔ̃/ (Tu = 2 <sup>nd</sup> person, singular)

#### High associative frequency

Nous pronoun and -ons inflection Vous pronoun and -ez inflection

#### Low associative frequency

Tu pronoun and -as inflection Je pronoun and -ai inflection

#### Experimental procedure of one trial:









n) Prime Interval 50 ms Duration is the length of sound

Duration is the length of sound

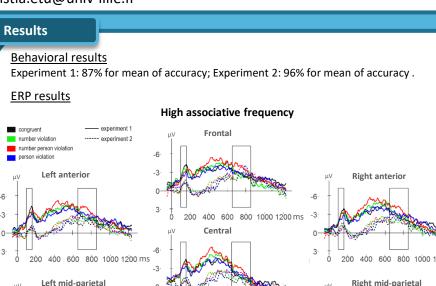
Experiment 1: No-go lexical decision task (LDT) – participants made a response if they hear a nonword. Experiment 2: Noun categorization task – participants made a response if they hear a noun.

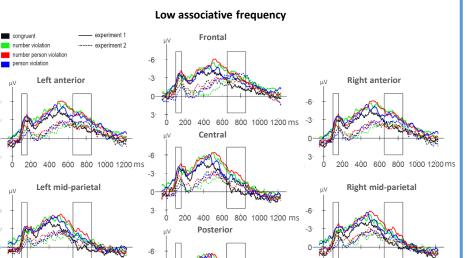
#### **EEG Pre-processing**

- The EEG signal was recorded with Biosemi (sampling rate 1024 Hz) and analyzed with Cartool.
- Voltage threshold: 100µV; filter: 0.1-30Hz.
- Data was time-locked to the onset of the verb. No baseline correction is applied.

### References

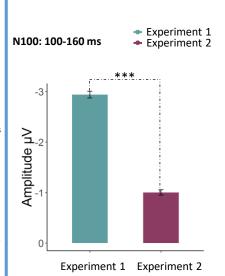
Mancini, S., Molinaro, N., Rizzi, L., & Carreiras, M. (2011). A person is not a number: Discourse involvement in subject-verb agreement computation arch; Nevins, A., Dillon, B., Malhotra, S., & Phillips, C. (2007). The role of feature-number and feature-type in processing Hindi verb agree Osterhout, L., & Mobley, L. A. (1995). Event-related brain potentials elicited by failure to agree. Journal of Memory and language; Seidenberg, M. S., & MacDonald, M. C. (1999). A probabilistic constraints approach to language acquisition and processing. Cognitive science; Aristia, J & Brunellière, A. (2017). Tracking the neurophysiological correlates during the putation of agreement dependencies: the access of grammatical feature and associative represer



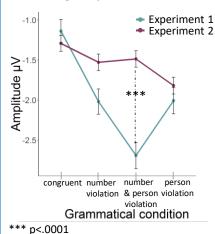


200 400 600 800 1000 1200 ms

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#### Anterior negativity: 650-850 ms



The early processing of verbs at the auditory level and the access of abstract representations at later stages were shaped by the task.

#### **Conclusion:**

These findings highlighted automaticity for use of based-statistical representations and flexibility in accessing abstract representations in subject-verb agreement.

600 800 1000 1200 ms