

## Eye-tracking predictive processing and cognitive decline

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Prediction plays a key role in language comprehension, supported by integration processes [1]. This study explores (1) how aging affects integration of high vs low cloze words during online reading and (2) the role of working memory capacity (WMC) in modulating aging effects. Predictive processing in young adults (YAs) enables faster reaction times and reduced fixations on high cloze vs. low-cloze words [2, 3]. Aging impacts predictive capacity as older adults (OAs) undergo cognitive decline. The few studies of aging and prediction in language processing to date yield conflicting results. Some report that OAs make slower, less precise predictions and exhibit more fixations and regressions on low-cloze words compared to YAs [4, 5]. Others state that while OAs may show slower predictions, contextual cues and individual differences, like cognitive reserve and linguistic experience, enhance predictive processing and reduce fixations and regressions, especially in familiar contexts [6, 7]. We conducted an eye-tracking study with 45 YAs (18-34 years; 22.97(3.44)) and 49 OAs (60-80 years; 69.30 (3.74)) healthy native Spanish speakers. Participants read Spanish sentences where the target noun was either expected (high-cloze condition) or unexpected (low-cloze condition) from the preceding context [8] (see figure 1). Their WMC was measured via the automated reading span task [9]. We expect that (1) YAs will show faster early integration (shorter first fixation durations) of high-cloze than low-cloze words than OAs, while OAs will exhibit larger late-stage effects (more regressions to and longer total reading times in low-cloze than high-cloze nouns) (Prediction 1); and (2) OAs with lower WMC will be worse at integrating complex information with more regressions and larger fixations, especially in low-cloze than high-cloze words (Prediction 2). LMER analyses revealed main effects of cloze probability (larger fixations and more regressions to low vs high-cloze words), WMC (larger fixations the lower their WMC) and group (larger fixations and more regressions by OAs than YAs) in the pre-, post- and critical ROIs (table 1). At the critical region, a cloze-probability-by-group interaction in *Total Time Durations* revealed larger cloze-probability effects for the OAs than the YAs (figure 2). This interaction was also significant at the pre-critical region in *Regressions In* (the count of regressions from the posteriors to the pre-critical ROI) and *Total Time Durations*, showing cloze-probability effects only for OAs. At the critical region, a 3-way interaction in *Regressions In* (regressions from post-critical to critical ROI) revealed different WMC by cloze-probability patterns for each group: while only YAs with larger WMC showed cloze-predictability effects, both OAs with large and low WMC showed cloze-probability effects. However, the effects were larger for those OAs with lower WMC (figure 3). Finally, a marginal ( $p=0.06$ ) cloze-probability by group interaction in *First Fixations* showed a trend for larger cloze-probability effects for YAs than OAs. Our results suggest that YAs predict more efficiently than OAs in early stages, while OAs show larger difficulties in integrating unexpected words at later stages. Interestingly, OAs with larger WMC showed to be better integrating unexpected nouns in sentences, suggesting that WMC serves as a compensatory mechanism in aging.

**References**

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**Materials and ROIs**

**High-cloze probability**

ROI 1	ROI 2	ROI 3	ROI 4
Ayer	fui	a la biblioteca a devolver	un libro
		en francés	de mi autor favorito.

Yesterday I went to the library to return a book<sup>HIGH PRED.</sup> in French by my favourite author.

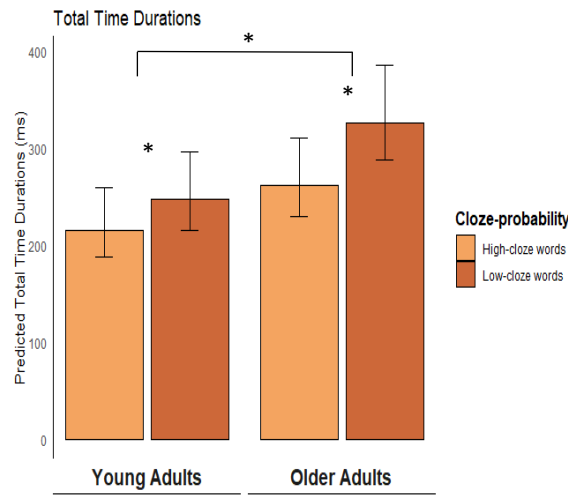
**Low-cloze probability**

Ayer fui a la biblioteca a devolver una peli en francés de mi autor favorito.

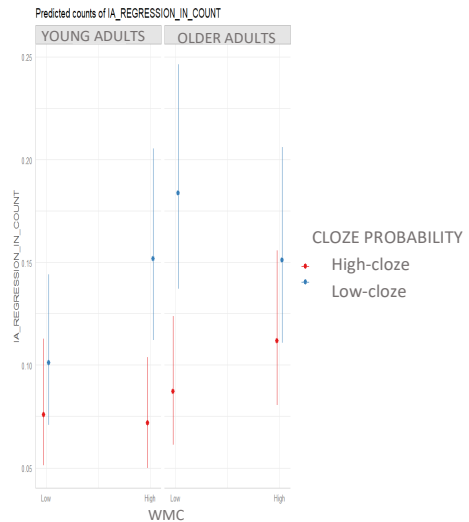
Yesterday I went to the library to return a film<sup>LOW PRED.</sup> in French by my favourite author.

**Gloss:** Yesterday I went to the library to return a French book/film by my favourite author.

**Table 1.** Sample sentences of an item in its two experimental conditions resulting from the manipulation of the cloze-probability (low vs. high-cloze verbs). The 4 ROIs created are marked in the first condition. From the 4 ROIs created, only ROIs 1, 2, and 3 have been analysed, being the one framed in red, ROI 2, the critical one.



**Figure 2.** Interaction of predictability by group at Total Time Durations.



**Figure 3.** Three-way interaction of predictability, WMC and group at Regressions In.