

How semantic prediction changes across the adult lifespan

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How language prediction changes across the adult lifespan remains a matter of considerable disagreement. Previous studies have suggested that older adults are less likely than younger adults to predict upcoming words due to working memory declines that limit the integration of prior context [1]. However, growing evidence now points to the preservation, or even improvement, of predictive processing at older ages, likely due to older adults' lifelong linguistic experience [2,3]. These conflicting findings may reflect age-related changes in the linguistic and non-linguistic processes that modulate prediction, including declines in working memory, processing speed [4], and word retrieval [5], but also gains in linguistic experience and vocabulary [6]. Moreover, most studies have compared discrete age groups despite evidence that many cognitive changes occur within middle to older adulthood [7]. Our study used a continuous-age design with a well-distributed sample of participants to examine the use of semantic cues for prediction across the lifespan. Crucially, to isolate age-related changes in linguistic processing from general cognitive decline, we employed the visual world paradigm with simple two-object displays and shorter auditory sentences, thus minimising working memory demands. Moreover, we examined the effects of age on predictive processing while statistically controlling for working memory and processing speed.

Method: We tested 134 European Portuguese native speakers (age range: 19–69 years) in a visual world eye-tracking experiment. In each trial, participants saw two objects while hearing an auditory instruction that included a verb (e.g., *comer* 'eat') whose semantic properties enabled predicting a target image representing its direct object (e.g., *bolacha* 'cookie') (Fig. 1A). The eye-tracking data was analysed with a GAMM-based method [8] that allowed estimating the effects of age on three complementary predictive measures: (i) overall proportion of looks to the target object during the predictive time-window; (ii) timecourse of fixations over time; and (iii) temporal onset of predictive effects.

Results and discussion: Our results revealed an increase in predictive looks to the target object with increasing age (Fig. 1B) and a significant age effect on the timecourse of fixations (Fig. 1C), indicating stronger semantic activation of predicted referents at older ages. We did not find an effect of age on onset times, suggesting that the speed of prediction remains consistent throughout life (Fig. 1D). Overall, these results show that increasing age can enhance the use of semantic cues to generate predictions. We propose that lifelong linguistic experience strengthens lexical links, enabling stronger semantic activation at older ages. However, any gains in onsets times from these stronger links may be outweighed by slower lexical retrieval in older ages. Our findings support the view that some predictive processing mechanisms are not only well-preserved, but might even improve at older ages [2,3].

References

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Figure 1: (A) Sample experimental trial. Participants were introduced to Glipi, and asked to select objects that would allow Glipi to perform various actions while hearing instructions such as *O Glipi vai comer a bolacha* ‘Glipi will eat the cookie.’. Age effect, when controlled by working memory and processing speed, on: (B) predictive looks to the target object; (C) timecourse of fixations across all ages and for the first quartile, mean, and third quartile ages in the samples; (D) predictive onset times. The ribbons show 95% confidence intervals.

