Age invariance in syntactic prediction during self-paced reading

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A great deal of controversy exists as to whether older adults are more, less, or equally as likely as young adults to make predictions about upcoming linguistic information during reading [1]. Many studies examining linguistic prediction in ageing have focussed upon lexical prediction of specific target words in sentences. In the current study we examined whether older adults use reliable linguistic cues to make syntactic– rather than lexical– predictions to a similar extent to young adults.

We presented readers with sentences in which an upcoming noun-phrase coordination structure was made predictable or left unpredictable through the presence or absence of the word *either* (e.g. *Josh will order either a large pizza or tasty calzone at the restaurant*). Prior work shows faster reading at *or* + the second noun phrase (e.g. *or tasty calzone*) when *either* is present earlier in the sentence in eye movements by young adults [2] and self-paced reading by older adults [3]. However, whether this effect is equivalent in the two age groups is unclear. Furthermore, [3] found a cost of the presence of *either* in a pre-target region (e.g. *a large pizza*) using self-paced reading with older adults, while [2] found no such cost for young adults during eye-tracking. As such, a secondary interest in the current study was to determine if this effect in older (and not young) adults was a form of prediction 'cost' due to cognitive ageing, or whether a similar effect is present in young adults in self-paced reading.

Sixty young adults (18-25 years) and 60 older adults (65+ years) read 32 sentences, half with *either* and half without *either*, in non-cumulative phrase-by-phrase self-paced reading. These items were presented alongside 88 filler items. This task was administered online using Gorilla.sc, a browser-based platform for remote data collection [4]. Sentences were presented in four regions (see Fig. 1). We examined effects in both target and pre- target regions. We analysed log-transformed reading times using Bayesian mixed models with Age Group and the presence of *either* as predictor variables, and a two-way interaction between these variables (see Fig. 2 for conditional means). At the target region, older adults read more slowly (b = 0.40, CrI[0.27,0.52], p(b>0=1)), and there was a facilitative main effect of the presence of *either* (b = 0.06, CrI[0.04,0.09], p(b>0=1)), but no interaction between these factors (b = 0.00, CrI[-0.05,0.05], p(b>0=0.51)). To further determine whether there were age differences in our effects we calculated Bayes Factors comparing a model including an interaction between age group and the presence of *either* with a model in which only main effects were present. The Bayes factor favoured the non-interactive model (BF_{10} = 0.068), suggesting that syntactic prediction is age invariant. In the pre-target region, older adults read more slowly (b = 0.32, CrI[0.21,0.44], p(b>0=1)), and there was a cost of the presence of *either* (b = -0.06, CrI[-0.08,-0.03], p(b>0=0)) but no interaction (b = 0.01, CrI[-0.04,0.06], p(b>0=.61); BF_{10} = 0.035), which might suggest a cost of making a prediction in the pre-target region, for both age groups.

We conclude that there are no differences between younger and older adults in the use of *either* to make syntactic predictions during self-paced reading. This was true for both the benefit of having made the prediction upon reading the target region, and any earlier cost associated with the presence of *either*. We suggest that efforts should be made to further investigate syntactic prediction in ageing, to determine whether a clearer pattern of results emerges across paradigms than has typically been the case for lexical prediction.

Predictable: Josh will order either | a large pizza | or tasty calzone | at the restaurant.

Unpredictable: Josh will order | a large pizza | or tasty calzone | at the restaurant.

Figure 1. An example of an item in each condition, with "|" symbols representing the demarcation of regions in the self-paced reading study. The target region always consisted of the word *or* and the following noun phrase, while the pre-target region consisted of the first noun phrase of the co-ordination structure.

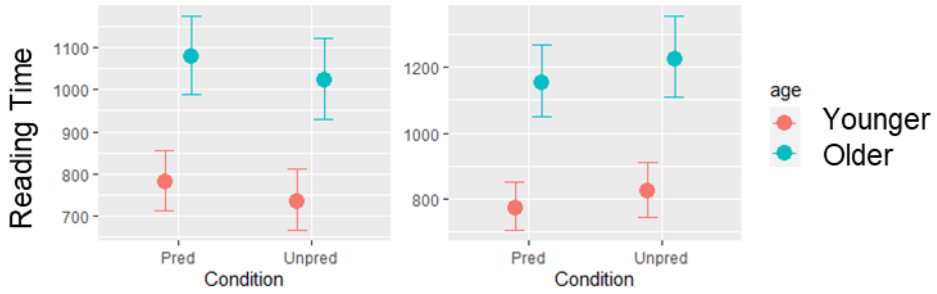

Figure 2. Predicted reading times from our Bayesian mixed models for our pre-target region (left; *a large pizza*) and target region (right; *or tasty calzone*). *Pred* represents the sentences in which *either* appeared as a predictive cue, while *Unpred* represents sentences in which this cue was absent.

References: [1] Payne, B. R., & Silcox, J. W. (2019). Aging, context processing, and comprehension. *Psychology of Learning and Motivation*, *71*, 215-264. https://doi.org/10.1016/bs.plm.2019.07.001 [2] Staub, A., & Clifton, C., Jr. (2006). Syntactic prediction in language comprehension: Evidence from either...or. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 32*, 425–436. https://doi.org/10.1037/0278-7393.32.2.425 [3] Warren, T., Dickey, M. W., & Lei, C. M. (2016). Structural prediction in aphasia: Evidence from either. *Journal of Neurolinguistics*, *39*, 38-48. https://doi.org/10.1016/j.jneuroling.2016.01.001 [4] Anwyl-Irvine, A. L., Massonié, J., Flitton, A., Kirkham, N. & Evershed, J. K. (2020). Gorilla in our midst: An online behavioural experiment builder. *Behavior Research Methods*, *52*, 388-407. https://doi.org/10.3758/s13428-019-01237-x