

Age, individual alpha frequency (IAF) and predictability shape interference effects

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Working memory capacity increases from childhood to adulthood and declines in older age (1). This development might influence effects of interference and prediction during language processing, because both draw on memory resources. While interference denotes processing difficulties that arise due to feature overlap of memory representations (e.g. 2), prediction is characterized as pre-activation of some features of these representations prior to perception (e.g. 3). Age is not the only factor influencing memory performance: individual alpha frequency (IAF) (4), a stable neurocognitive marker of information processing, positively correlates with performance in memory tasks (5). We present an ERP experiment that investigated individual differences in the role of age and IAF on interference and prediction. In previous work it was found that, in young adults, an N400 for unpredicted words was more pronounced for high interference conditions than for low interference conditions (6). We hypothesized that children and older adults would show a different magnitude of interference effects than young adults due to reduced memory capacity and, additionally, that high-IAF participants would show reduced interference effects.

84 healthy, right-handed, native speakers of German (28 children (10-13 years), 32 young adults (18-35 y.), 24 older adults (61-72 y.)) read sentence pairs word-by-word (see Table 1). A context sentence introduced two noun phrases (NPs). In the target sentence, one of the NPs (*den Käfer*, eng.: 'the beetle' [masc.]) was referred back to and the article (*den*, eng.: 'the' [masc.]) within that phrase was our critical word. We assumed that processing of the article would trigger a prediction of the upcoming noun, which involves retrieval of the NPs in memory. The distance between retrieval site and target was varied through a word order manipulation in the context sentence. Short distance (no intervening material) has been found to reduce interference effects (2). Interference was manipulated via a gender match (high interference)/mismatch (low interference) between the NPs in the context and the article. In high interference conditions, the article matched with the gender feature of both NPs, hence it is not possible to determine the target of the retrieval at the article. Therefore, we pooled the data of both high interference conditions for analysis. In low interference conditions, only one NP in the context matched with the article. Predictability of the article and following noun was measured via cloze probability.

We analyzed mean single trial EEG activity in the N400 time window with linear mixed models. Results revealed an interaction between interference, predictability of article and noun, IAF and age group. The interaction was driven by effects within the child (see Figure 1) and young adult age groups as the older adults showed no effects. Most pronounced interference effects (largest N400 amplitude differences) were found under low predictability, i.e. low article and noun cloze. Low-IAF children showed an N400 for low interference conditions with a close distractor compared to low interference with a distant distractor and the high interference conditions. High-IAF children showed the opposite effect. We propose that these opposite patterns between low- and high-IAF children were due to differences in information processing. Specifically, low-IAF children showed a primacy effect (preference for the first mentioned noun to be re-mentioned) and high-IAF children showed a recency effect (preference for the last mentioned noun). Within their age group, only the low-IAF young adults showed effects: An N400 for high interference conditions compared to the low interference condition with a distant distractor. This partially replicates previous results and resembles the effects of the high-IAF children. Older adults showed no results, which might be due to increased variance within that age group (7). We conclude that retrieval interference effects during language comprehension depend not only on word predictability but also on IAF and chronological age.

Table 1: Example stimuli (originals in black, translations in gray). Critical word is bold.

Conditions	Context sentences
(1) high interference / close distractor	In der Schachtel sitzt ein Käfer und im Glas liegt ein Wurm. 'In the box there sits a beetle[masculine] and in the glass there lies a worm[masculine].'
(2) high interference / distant distractor	Im Glas liegt ein Wurm und in der Schachtel sitzt ein Käfer. 'In the glass there lies a worm[masculine] and in the box there sits a beetle[masculine].'
(3) low interference / close distractor	In der Schachtel sitzt ein Käfer und im Glas liegt eine Raupe. 'In the box there sits a beetle[masculine] and in the glass there lies a caterpillar[feminine].'
(4) low interference / distant distractor	Im Glas liegt eine Raupe und in der Schachtel sitzt ein Käfer. 'In the glass there lies a caterpillar[feminine] and in the box there sits a beetle[masculine].'
	Target sentence
for all conditions	Peter befreit den Käfer aus der Schachtel. 'Peter frees the[masculine] beetle[masculine] from the box.'

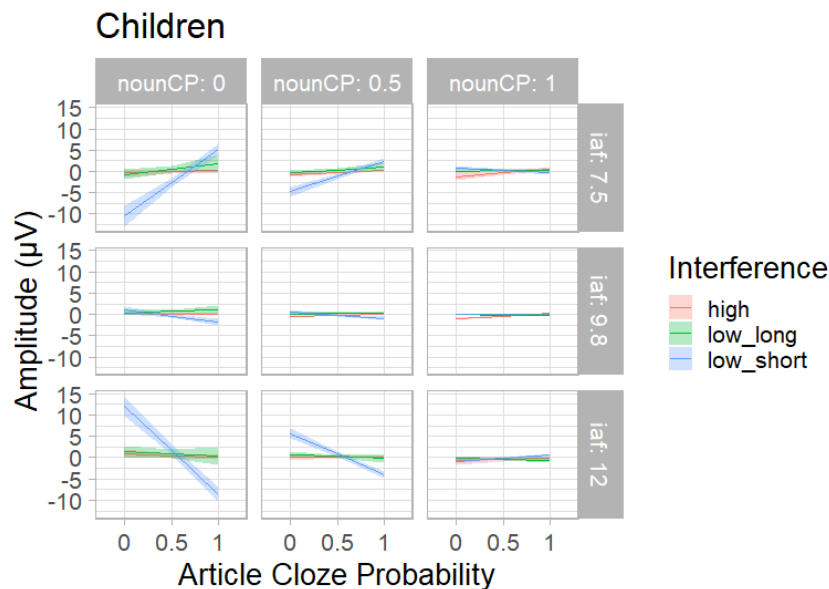


Figure 1: Visualization of the interaction between interference, article CP, noun CP and IAF within the child age group. Shaded areas indicate 95 % confidence intervals. IAF bins are equally spaced within the IAF range of all our participants.

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