Idiom Processing Across the Adult Lifespan

As people age, language processing undergoes various changes that reflect both individual cognitive trajectories and cumulative language experience. On the one hand, age-related declines in domain-general cognitive functions, such as working memory capacity and inhibitory control, can increase the demands of online sentence comprehension and lexical access (Salthouse, 1996; Hasher & Zacks, 1988; Wingfield & Grossman, 2006). On the other hand, older adults possess a rich reservoir of semantic knowledge and pragmatic competence acquired through lifelong exposure to language, which can facilitate predictive processing (Kavé & Halamish, 2015; Verhaeghen, 2003; Umanath & Marsh, 2014). Rather than reflecting a uniform decline, aging entails a dynamic process in which older adults draw on crystallized linguistic knowledge and compensatory strategies to preserve, and occasionally enhance, language comprehension across the lifespan.

One domain where age-related changes are especially evident is the resolution of linguistic ambiguity, which requires readers to select the intended meaning among multiple alternatives. Constraint-based models argue that language users resolve such ambiguity by integrating probabilistic cues, such as word frequency, syntactic structure, and contextual support, in real time (MacDonald et al., 1994; Kuperberg & Jaeger, 2016). Although older adults typically retain strong language knowledge, age-related declines in executive functions can make it more difficult to efficiently integrate multiple cues during online processing (Dagerman et al., 2006; Caplan & Waters, 2005). Consequently, older adults tend to rely more heavily on highly constraining contextual information as a compensatory strategy to overcome reduced cognitive control (la Roi et al., 2020; Federmeier & Kutas, 2005).

Idioms offer a particularly informative case for studying how aging affects language comprehension, because they are ambiguous between a literal and a figurative interpretation (e.g., “spill the beans”). Comprehending an idiom involves accessing a stored figurative representation and suppressing the literal interpretation, especially in neutral contexts (Cacciari & Tabossi, 1988; Titone & Connine, 1999). While idioms are stored as holistic phrasal units (Sprenger et al., 2006) and idiom knowledge tends to remain robust or even improve with age (Carrol, 2023; Sprenger et al., 2019), their processing still requires executive control (Rommers et al., 2013). Recent eye-tracking research shows that older adults exhibit increased reading times when idioms appear in noncanonical structures, indicating reduced cognitive flexibility and a stronger reliance on familiar forms (Haeuser et al., 2021). Moreover, older adults appear to depend more on supportive context to facilitate idiom interpretation, compensating for declines in inhibitory control and working memory (la Roi et al., 2020).

In the present study, we investigated how idiomatic processing during reading evolves across the adult lifespan by combining eye-tracking with behavioural assessments of cognitive functioning. A total of 110 Dutch-speaking adults aged 30–80 years participated. All participants completed a sentence reading task while their eye movements were recorded, as well as an idiom familiarity questionnaire and a battery of tasks assessing working memory, inhibitory control, cognitive flexibility, associative learning ability (Hake et al., 2023), and reading exposure using the Dutch Author Recognition Test (Brysbaert et al., 2020).

The experimental materials comprised 44 Dutch idiomatic phrases paired with closely matched literal counterparts, all matched for syntactic structure to enable direct comparison, and each sentence was embedded in either a biasing context that supported an idiomatic interpretation or a neutral context lacking such cues, yielding four conditions: idiomatic in supportive context, idiomatic in neutral context, literal in supportive context, and literal in neutral context. A Latin-square counterbalancing design ensured that each participant encountered every item in only one condition. Each trial presented the context sentence first, and the critical sentences followed a consistent subject–object–verb structure across all conditions with an identical initial noun phrase in the idiomatic and literal versions to prevent premature anticipation of the intended interpretation. In addition, 44 garden-path sentences and their controls were included as fillers to vary syntactic complexity and reduce predictability. Eye-tracking analyses targeted multiple measures in the target region as well as pre- and post-target regions to capture both early and later stages of processing. Data were analysed using mixed-effects regression models including fixed effects of idiomaticity, context predictability, age, and individual-differences measures, as well as random effects for participants and items.

The results showed that idiomatic expressions were processed more rapidly than their matched literal counterparts in both early and late eye-movement measures, indicating a reliable processing

advantage for idioms. Context strongly modulated this pattern: in idiom-biasing contexts, idioms were processed more efficiently whereas literal continuations incurred increased reanalysis costs, while these effects were weaker in neutral contexts. Analyses of age did not reveal a global age-related slowdown. Instead, age-related effects were primarily observed in reanalysis measures, following a nonlinear pattern. To characterize individual differences, we conducted a principal component analysis on the cognitive measures, which yielded two factors corresponding to working memory and cognitive flexibility. These cognitive factors, rather than chronological age per se, accounted for substantial variability in idiom processing. Higher working memory was associated with a larger processing advantage for idioms in both early and later measures, and cognitive flexibility selectively modulated the integration of contextual information and the suppression of literal interpretations. In addition, reading exposure and associative learning ability primarily affected later processing stages, strengthening context use and reanalysis patterns, while greater idiom familiarity reduced overall reading times. Together, these findings show that idiom comprehension remains efficient across adulthood, that supportive context guides processing and makes literal interpretations costly, and that individual differences in working memory and cognitive flexibility selectively support comprehension when contextual integration or suppression of literal meanings increases processing demands, rather than producing a general facilitation of reading.

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