Anticipatory eye movements in wh-movement: A comparison of younger and older adults
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Studies have shown that people can anticipate an upcoming word (or object) based on several types of linguistic constraints, such as a verb’s selectional restrictions (Altmann & Kamide, 1999). Sussman and Sedivy (2001) also observed anticipatory eye movements in sentences containing wh-movement. When participants heard questions (e.g. What did Jody squash the spider with?), they found that people tended to anticipate the object (spider), whilst hearing the verb (squash). However, there has been some controversy about the input rate of speech and people’s ability to actively predict gaps in wh-questions (Dickey & Thompson, 2009; Love, Swinney, Walenski, & Zurif, 2008). In this study, we used the visual world paradigm to examine how speech rate and general processing speed influence the comprehension system’s ability to anticipate an upcoming object in a wh-question. We systematically varied speech rate (3.5, 4.5, or 5.5 syllables per second), and to investigate individual differences in processing speed, we tested older adults. Prominent theories of ageing assume a general decrease in processing speed throughout middle and late adulthood (Salthouse, 2009). We predicted that older adults would be slower shifting attention to the relevant object in the display compared to younger adults. More importantly, if input rate also affects people’s ability to actively anticipate an upcoming object, then we expect an interaction between input rate and processing speed.

Participants viewed arrays of objects and listened to short narratives, for example, about a boy kissing a girl at school. The array contained a boy, a girl, a school, and a distractor. Participants were then asked a question (e.g. Who did the boy kiss at school?), and they had to click on the correct image. We analyzed eye-movements and comprehension accuracy using 2x3 (age group x speech rate) mixed model ANOVAs. The duration of the word following the verb was 200-320ms. Given that it takes approximately 200ms to program a saccade, we examined target-advantage scores (target minus competitor) for the word following the verb (word 1), under the assumption that fixations during this window were programmed during the second half of the verb or immediately after. Results from the verb (verb) and the second word after the verb (word 2) were also analyzed. We found a significant linear effect of input rate at word 1 \( F(2,72) = 4.01, p < .05 \) and word 2 \( F(2,72) = 3.09, p < .05 \) (see figure). Simple effects revealed a significant difference between the 3.5 and 5.5 syllable/sec rate for both word 1 \( t(37) = 2.47, p < .05 \) and word 2 \( t(37) = 2.65, p < .05 \). We found no effect of age at any word. However, we ran sub-analysis on adults over 46 yrs \( (N = 11, M = 56.9) \). A one-sample \( t \)-test, with a test value of zero, revealed that they performed no differently from chance in both the 4.5 \( t(10) = .81, p = .44 \) and 5.5 \( t(10) = .54, p = .60 \) syllable/sec conditions. This suggests that processing speed can also influence the extent to which people anticipate upcoming objects in speech. There was no difference in comprehension accuracy. Results are consistent with previous work in demonstrating that the comprehension system will actively predict a gap following the verb and actively anticipate the object of that verb when the input rate allows. Moreover, these results (1) resolve the debate concerning how different input rates affect online processing, and (2) have implications for the speed in which incremental interpretations can be exploited in the service of active prediction in language comprehension.
References:


