Fast reading and fast listening: Evidence for individual differences in sentence comprehension

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Introduction: Although individual differences have been documented throughout the language system, it remains unclear whether native speakers vary in the efficiency with which they process naturalistic sentences. In the current study, we capitalized on the fact that language comprehension is constrained by the rapid and transient nature of incoming input and used speed pressure to reveal individual differences in sentence comprehension that would otherwise be difficult to detect [1]. Participants read sentences presented rapidly word-by-word and listened to sentences played at accelerated rate and conducted semantic plausibility judgements. We examined whether performance varied systematically across individuals and whether it was related to domain-general cognitive abilities (processing speed and short-term memory) and print exposure.

Methods: 200 participants (native English speakers recruited via Prolific) completed speeded sentence comprehension tasks in reading and listening. For each test, 80 sentences were selected from a naturalistic corpus of English [2]. We replaced a key noun with a semantically implausible substitution in half of the items ("*She knocked on the cloud* (originally: *door*) *so hard that she almost broke it down*."). Participants judged whether each sentence "made sense". After extensive piloting, we selected five speeds per presentation mode[1]. Performance was indexed by comprehension accuracy. Participants also completed forward and backward digit-span tasks, two tests of visual processing speed and a spelling and author recognition test [3] (to index print exposure).

Results: The two comprehension tests were well-matched for difficulty (Listening: mean 80% correct; Reading: 78%). Split-half reliability was high (Listening: 0.87; Reading: 0.89). Scores on the two comprehension tests were strongly correlated ($r = 0.77$). Performance in both modalities was moderately correlated with processing speed and weakly correlated with print exposure, with a stronger print exposure effect in reading (see Figure 1). A generalized linear mixed effects model showed significant main effects of stimulus speed ($\beta = -0.54$, $p < 0.001$), print exposure ($\beta = 0.32$, $p < 0.001$) and processing speed ($\beta = 0.55$, $p < 0.001$). There were also significant interactions between presentation type (Listening/Reading) and print exposure, with a greater effect of print exposure on the reading test ($\beta = 0.08$, $p < 0.001$; see Figure 2), and between stimulus speed and processing speed ($\beta = -0.10$, $p < 0.001$).

Discussion: We found that performance was highly reliable within the speeded tasks and generalized across reading and listening modalities, providing evidence for modality-independent individual differences in sentence comprehension under time pressure. Processing speed strongly predicted performance in both tests. This suggests that rapid perceptual uptake and encoding of linguistic input support efficient integration before the input stream advances. Performance in both tasks was also predicted by print exposure. The effect was stronger in the reading task, but importantly, also present in the listening task. This supports theories that reading strengthens modality-general lexical representations. Accordingly, richer and more automatized representations support more efficient and predictive mapping from transient input to sentence-level meaning [4]. Overall, the results suggest that sentence comprehension depends jointly on domain-general processing efficiency and the quality of linguistic representations. More broadly, we propose that sentence processing efficiency is a meaningful dimension along which native speakers differ.

References

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[3] Stanovich, K. E., & West, R. F. (1989). Exposure to print and orthographic processing. Reading research quarterly, 402-433.
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Footnotes

1: Reading speeds were 353 / 414 / 500 / 632 / 857 wpm in rapid serial visual presentation. Listening speeds were 312 / 379 / 458 / 493 / 582 wpm, using audio files sped to 140-280% of recorded speech rate.

Figures

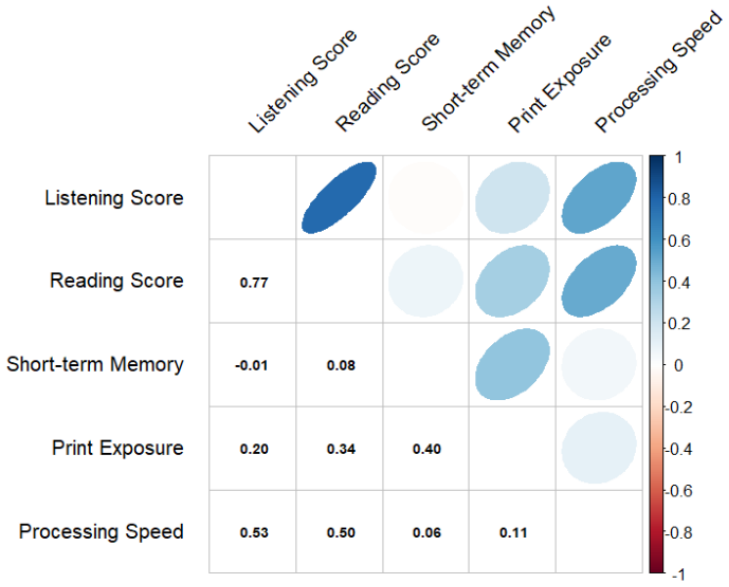

Figure 1: Correlation matrix (Pearson's r) showing relationships between reading and listening comprehension, print exposure (spelling, author recognition), short-term memory (forward and backward digit span), and processing speed (simple and choice reaction times). Composite scores are mean z-scores.

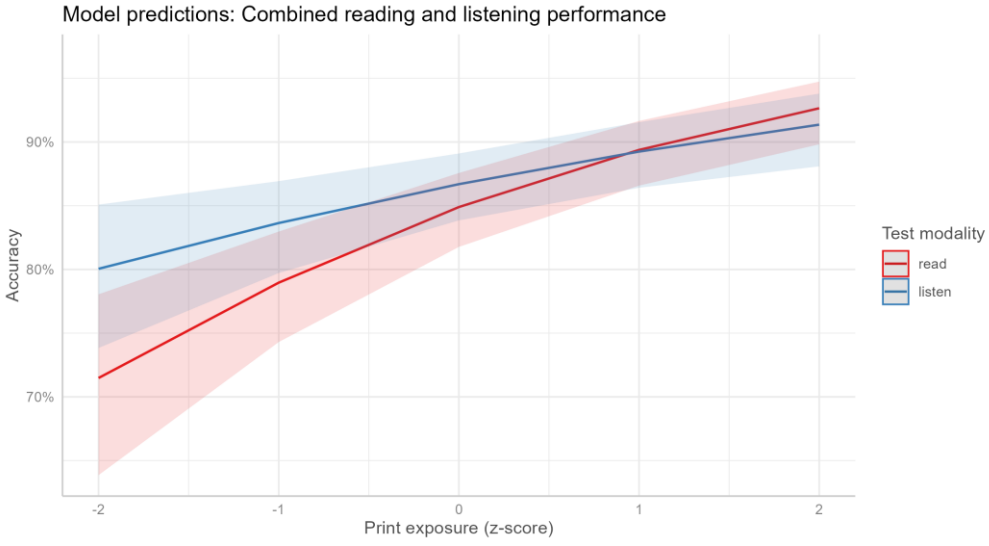

Figure 2: Model-predicted interaction between test modality (reading vs. listening) and print exposure (mean z-scored performance on spelling and author recognition tasks), illustrating a stronger effect of print exposure in reading than in listening