Associations Between Speech and Language Performance in Adults

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RATIONALE

Comorbidity is high between communication disorders. People with a language disorder may have weaknesses in speech motor and articulation; whereas people with with speech disorders may also present with language concerns. For example, adults with dyslexia have lower levels of performance on speech-motor (e.g., syllable repetition; Peter et al., 2018) and lexical-semantic (e.g., word definition; Goranova, et al., 2021) tasks compared to peers with typical reading. However, there is little work examining these connections in adults in the general population. We examined how different scoring metrics influence these relationships. We had two research questions:

1. **Are syllable repetition, spelling, and word definition correlated in the general population?**
2. **Do these correlations vary based on scoring method?**

METHODS

Procedures. Tasks were coded using jspsych and delivered remotely on cognition.run. Participants were instructed to use a laptop or desktop computer with a compatible internet browser (Chrome, Edge, or Explorer) and to use headphones. Participants completed a battery of speech and language tasks, which took an average of 50mins to complete. Syllable repetition was multisyllabic diadokinechtics (Fletcher, 1972) and responses were spoken. Irregular word spelling and word definition tasks were based on Fidler, Plante, and Vance (2011) and responses were typed.

Task	Measures	Time
Syllable Repetition (DDK)	Speech-motor	3 mins
Irregular Word Spelling (IWS)	Grapheme-phoneme	5 mins
Word Definition (WD)	Lexical-semantic	10 mins

Data quality checks. Participant responses were screened to detect bots and bad faith actors using IP addresses and native speakers reviewing spoken responses for non-native accents.

PARTICIPANTS

Recruitment and **data collection** occurred between June and November 2022 using flyers, emails, and web page posts.

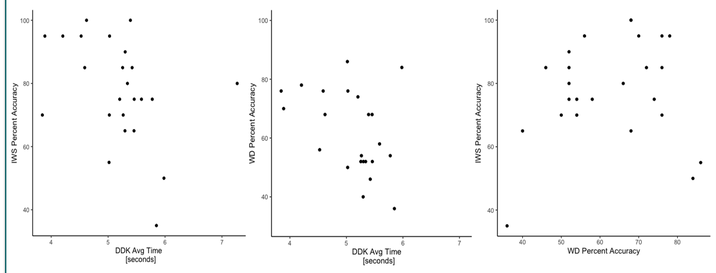
Our **inclusion criteria** were native speaker of an American English dialect, educated in the United States, and no history of hearing loss, neurological trauma, or cognitive decline.

Demographics. Participants passing screening (n = 25) had a median age of 30.

Self-reported Gender (Female = 18; Male = 6; NR = 1)
Self-reported Race (White = 16; Asian/Indian = 4; Other/NR = 5)
Self-reported Ethnicity (Hispanic/Latino = 4; Unknown/NR = 21)

Performance. DDK had an average time of 5.19 seconds (SD = 7.12) for 10 repetitions across two attempts. IWS had an average of 78% accuracy (SD = 16.07). WD had an average of 62.56% accuracy (SD = 13.64).

HUMAN SCORING RESULTS



DDK-IWS *r* = -0.38 **DDK-WD *r* = -0.31** **IWS-WD *r* = 0.17**

Based on human scoring these tasks are **weakly correlated**. These results imply speech and language are **disassociated** in the general population when using clinical scoring methods.

AI SCORING RESULTS

For DDK and Irregular Word Spelling, we used **edit distance-based** scoring measures to compare participant response to the target, with lower scores indicating responses closer to target. For WD, we used **paragraph embedding techniques** (i.e., sentence embeddig) and **computed the cosine similarity** between participant response and target, with higher scores indicating closer similarity.

Performance. IWS had an average of 94.36% precision (SD = 0.05). WD had an average of 72.22% accuracy (SD = 9.46). Pearson correlation between IWS and WD is r= -0.03.

Automated analysis confirms the results of the human scoring for WD and IWS task.

CONCLUSIONS

We found no large correlations between syllable repetition, spelling, or word definition in the general population. These findings imply that **speech-motor, grapheme-phoneme, and lexical-semantic knowledge are disassociated by adulthood.**

References

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