Speech latency analysis for clinical trial enrichment: Towards industrial scalability

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Introduction

Speech latency may be a proxy measure of psychomotor slowing with face validity and empirical support that can be assayed directly from psychiatric interviews without burden of additional testing.

We found that automated measurement of speech latency from structured psychiatric interviews showed reliability, convergent validity, sensitivity to change, generalization across socio-linguistically diverse countries, and potential as an enrichment tool for depression trials.

We attempted to replicate these findings using a cloud-based pipeline allowing for near-real-time measurement in regular clinical trial operations.

What are Speech Latencies?

Speech latencies are the time elapsed between the rater's question and the study participant's response.

Q: How are you feeling today?

Between Turn Latency

A: . . . . . Not great, I guess

What was "Replicated"?

We evaluated Audio recordings from Montgomery–Åsberg Depression Rating Scale (MADRS) interviews for a completed Phase 2 clinical trial, including:

- k = 1369 recordings
- N = 274 participants from seven recruitment countries.

Original System: The original analysis was conducted by the Affective Science and Psychopathology Laboratory at LSU, licensed to Quantic Innovations.

Replication System: Replication was conducted using a scalable cloud-based pipeline developed by Brooklyn Health.

Analyses

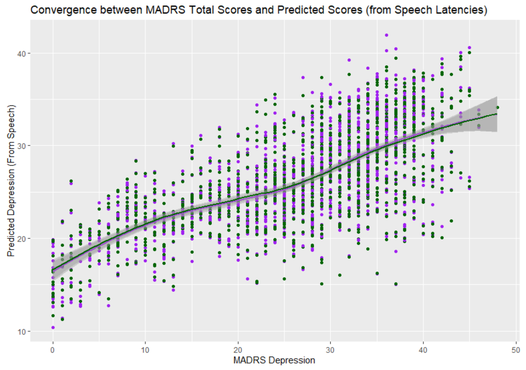
We evaluated:

- Internal consistency of latencies within each session
- Temporal stability of latencies between sessions
- Convergence with MADRS total scores
- Ability to differentiate depressed from remitted patients
- Sensitivity to change in depression
- Utility for enrichment, by excluding participants with "normal" latencies from pre-randomization sessions (defined based on post-randomization data) from the analysis.
- Replicability across 7 countries

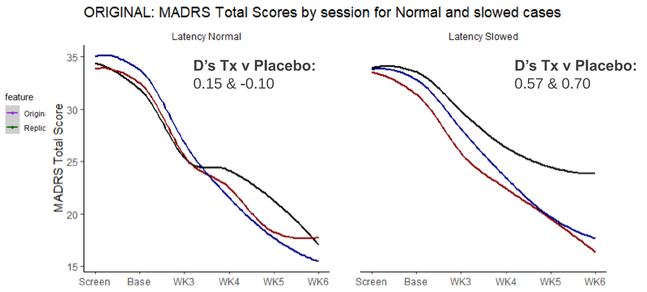
Both systems show similar internal consistency (within sessions).
Coeffecient alphas were 0.97 and 0.94 for the original and replication analyses.

Both systems show similar temporal stability (between sessions).
ICC values were 0.70 and 0.67 for the original and replication analyses.
ICC values for MADRS total scores was 0.30

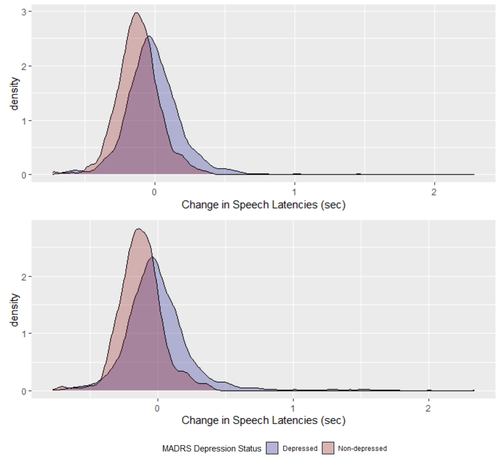
Both systems similarly converge with MADRS total scores.



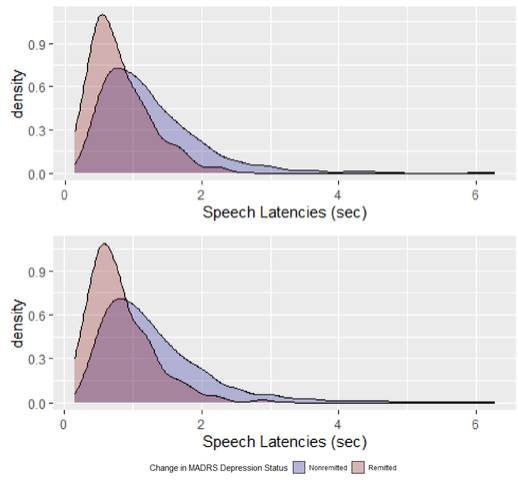
Both systems show improved treatment outcome using speech latencies to enrich sample

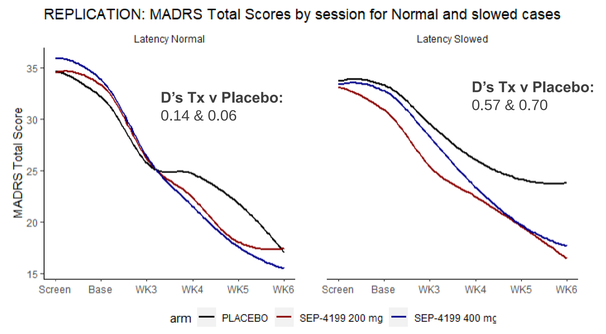


Both systems similarly differentiate people whose depression remitted from those that didn't remit



Both systems similarly differentiate depressed from non-depressed patients.





Conclusions

Speech latencies are a vocal biomarker of psychomotor slowing; a key aspect of depression.

Speech latencies can be used improve treatment outcomes by enriching study samples.

Use of a cloud-based pipeline replicated prior reliability and validity, and provides new industrial scalable, regulatory-compliant opportunities.

Next steps are to further validate these systems for use in clinical trials.

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