Use of Technology to Remotely Assess Language as a Non-Invasive Biomarker: The Importance of Language Task

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Introduction

- Growing evidence supports the use of **discourse** (i.e., connected speech/language) as a cost-effective and ecologically-valid means of identifying individuals with prodromal Alzheimer's disease (AD). [1-3]
- **Semantic content** metrics (i.e., meaning of the message) are sensitive to early differences in MCI and cognitively unimpaired (CU) older adults. [2-3]
  - Analyses were primarily based on spoken discourse samples from a brief, decontextualized picture description task (i.e., "Cookie Theft") [2-7]
- Findings from the Cookie Theft discourse task may be **task-specific** and not generalize to functional contexts. [8]
- **This study aims to:**
  - **Compare three semantic content metrics across six different discourse tasks**
  - **Evaluate the feasibility of the procedure using various technologies (i.e., Zoom, "BatchAlign," CLAN)**

Methods

- Discourse data were taken from the DementiaBank Delaware Corpus [6] (part of TalkBank)
- Via Zoom, participants completed six discourse tasks (Table 1) & a cognitive-linguistic battery for cognitive classification
- Participants were classified as MCI (n=43) or CU (n=24) based on NIA-AA criteria [9]

Table 1. Delaware Corpus Discourse Data

Discourse Type	*Task*
Picture Description	Cookie Theft [4]
Story Narrative	Cat Rescue [13]
	"Going and Coming" [14]
	Cinderella [15]
Procedural Discourse	PB&J
Personal Narrative	Hometown

Discourse Transcription

- Discourse samples were transcribed using an automatic speech recognition (ASR) pipeline (Table 2) and analyzed using CLAN software. [12]
- The ASR pipeline reduced transcription time from ~10 hours to <2 hours per transcript

Table 2. "BatchAlign" Pipeline [11]

Step	*Description*
Automatic Speech Recognition	Develops diarized transcripts
Utterance Tokenization	Segments word streams into utterances based on speaker identity
Automatic Corrections	Reformats common words and reassigns codes with CHAT format [10] and CLAN codes [12]
Speaker ID Assignments	Human assigns speaker ID codes
Forced Alignment	Associates each utterance & word with a beginning/end time in milliseconds
User Adjustments	Human completes error check using CLAN
Automatic Morphosyntactic & Profiling Analyses	Assigns morphological and syntactic structure to transcripts

Analysis & Results

1. Extracted three semantic content variables [1] using CLAN [12]
- % Noun; % Verb; Pronoun Index

2. Screened for interaction effect of Cognitive Status x Task; yielded non-significant effects (all *p*'s > 0.05)

3. Aggregated Tasks by Cognitive Status

4. Conducted one-way ANOVAs for each semantic content variable (all *p*'s < .001)
- $F_{\%noun}$ (5, 394) = 30.63 (Fig. 1)
- $F_{\%verb}$ (5, 391) = 31.64 (Fig. 2)
- $F_{pronoun\_prop}$ (5, 391) = 23.68 (Fig. 3)

5. Post-hoc comparison suggest highest semantic content variables are elicited from these tasks:
- % Noun → PB&J
- % Verb → Cat Rescue
- Pronoun Index → Cinderella

Results

Figure 1. Percent Noun Boxplot

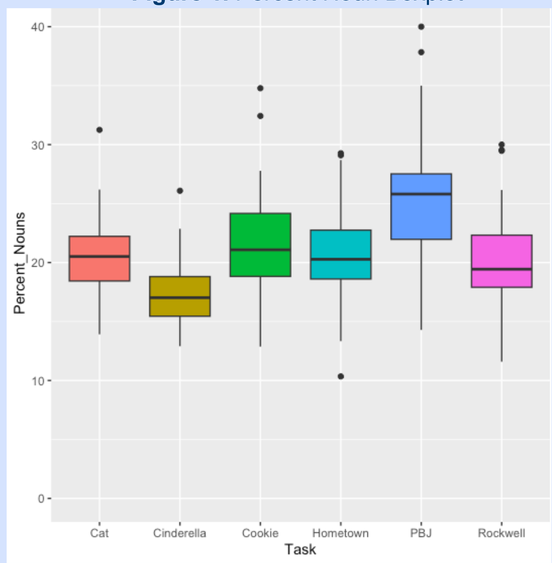


Figure 2. Percent Verb Boxplot

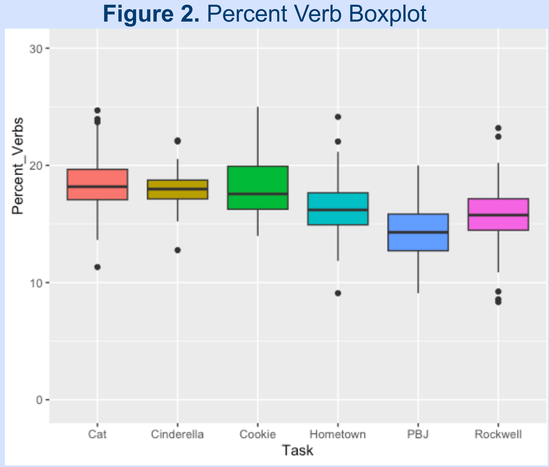
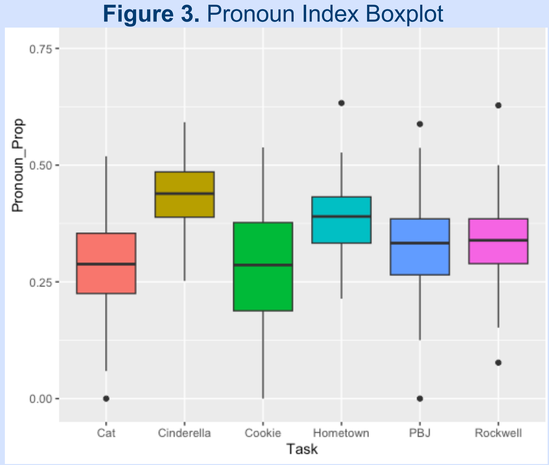


Figure 3. Pronoun Index Boxplot



Conclusions

- **Use of technology supported efficient data collection and analysis**
  - Zoom platform for remote data collection supported wider recruitment and participation
  - "BatchAlign" pipeline streamlined transcription to make the process more efficient and standardized
  - CLAN software (part of TalkBank) automatically extracted semantic content variables of interest
- **Different discourse tasks elicited varying levels of semantic content variables**
  - As researchers continue to use discourse as a measure of cognitive decline for people with MCI, they should consider discourse tasks that are more sensitive to their aims.

Get Involved!

- **Join the DementiaBank Consortium**
  - Scan the QR code
- **Analyze data** from the Delaware corpus
- **Contribute your own data**

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