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Intonation in English speakers with Alzheimer's Disease

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Introduction

- Alzheimer's disease (AD):
  - progressive neurodegenerative disorder.
  - causes gradual erosion of cognitive functioning.
  - begins decades before symptoms.

Background

- Lots of research on automatic detection of AD, but little on underlying acoustic correlates.
- Assessed AD using biosignatures.
- Martinez-Sanchez et al. study:
  - 42 speakers (21 AD and 21 control).
  - flattened pitch trajectories in Spanish-speaking AD patients compared to controls [1].

Do English speakers with Alzheimer's Disease exhibit flattened pitch trajectories?

Methods

- 1 file from 203 English speakers (128 AD and 75 control) from Dementiabank Pitt Corpus [2].
  - each file contained approximately 1-2 minutes of speech
- Voice recordings of "Boston cookie theft" Picture Description Task.

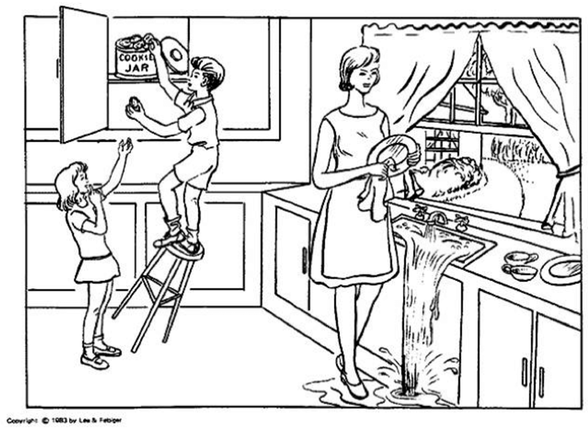
	Male Ps.	Female Ps.	Total:
Control Ps.	29	46	75
AD Ps.	43	85	128
Total:	72	131	203

Processing

- Dartmouth Linguistics Automation (DARLA) force-aligned audio files and manual transcriptions [3].
- Pitch trajectories assessed using Prosogram [4]. Intermediate data profiles and prosodic profiles calculated.
- Script settings: non-adaptive threshold
  - M: F0 detection range of 60-200 Hz
  - F: F0 detection range of 100-300 Hz

Boston Cookie Theft Description Task

Image used in the Boston Cookie Theft elicited production description task, which the participants described in their voice recordings for the Pitt corpus, which was used for the present analysis.



Results

- AD had greater pitch range and trajectories across phonation than controls, both within and across syllables.

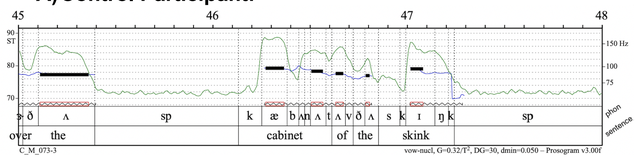
	Control Male	AD Male	Control Female	AD Female
Intersyllabic Trajectories	13.65 ST	14.39 ST	15.84 ST	16.38 ST
Intrasyllabic Trajectories	1.98 ST	2.75 ST	2.72 ST	3.33 ST
Pitch Range	13.2 ST	12.9 ST	15.3 ST	15.0 ST
Pitch Mean	114.0 Hz	120.1 Hz	165.8 Hz	179.7 Hz

- Condition (AD or control), independent of gender
  - significant difference for intrasyllabic trajectories (ANOVA, p-value = 0.036).
  - not significant for intersyllabic trajectories (p-value = 0.514).

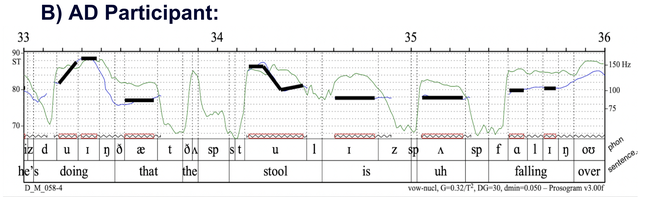
Prosogram Graphic Files

Output files from Prosogram which show the pitch trajectories for a phrase in (A) Control and (B) AD Participants.

A) Control Participant:



B) AD Participant:



Discussion

- Preliminary findings conflict with previous observations of a flattened prosodic profile for AD patients.
- This discrepancy could be the result of language, speech elicitation methods, or dataset specific confounds such as recording quality.
- Further research should replicate this study in various languages and using different speech elicitation methods.

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