

Acoustic Analyses of Expressive Prosodic Impairments in People With Dementia

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Introduction

Expression and perception of emotion can be impaired in people with cognitive impairments such as dementia of the Alzheimer's type (DAT) and mild cognitive impairments (MCI). Thus, prosodic analyses of speech may differentiate between neurotypical controls and people with mild dementia.

The purpose of this study was to analyze various prosodic components of speech from utterances produced by age-matched neurotypical controls (CONTR), people with DAT, people with vascular dementia (VASC), and people with mild cognitive impairment.

We hypothesized that the prosodic analyses will provide patterns that differentiate among the speaker groups.

Methods

Participants – Prerecorded speech samples from the DementiaBank of people describing the *Cookie Theft Picture* provided the speech samples for this study. Included in this data set were 9 people DAT) 9 people with MCI, 5 people with VASC, and 10 CONTR.

Procedures – The files were divided into utterances with two researchers agreeing to the utterance divisions for all speakers.

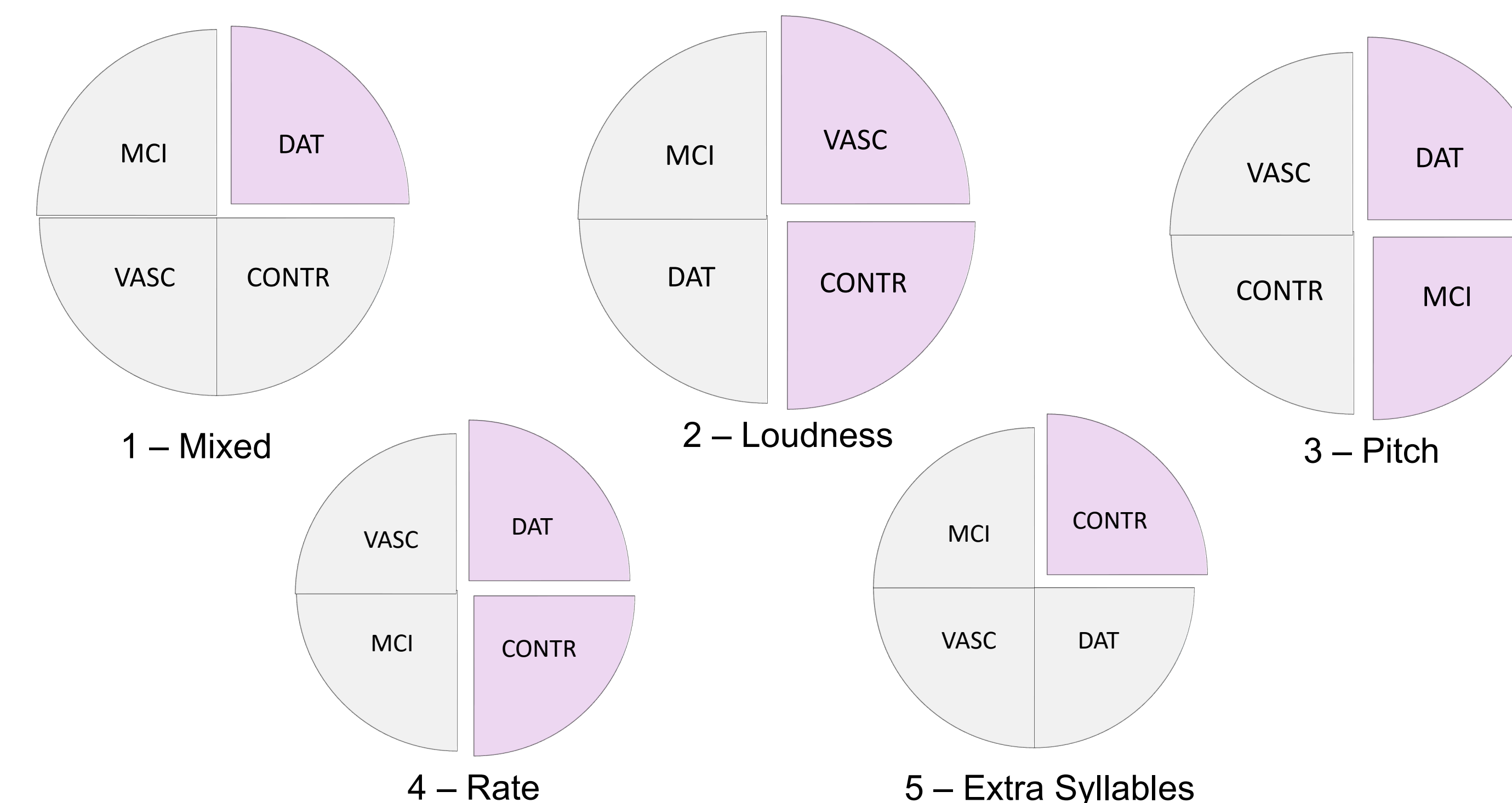
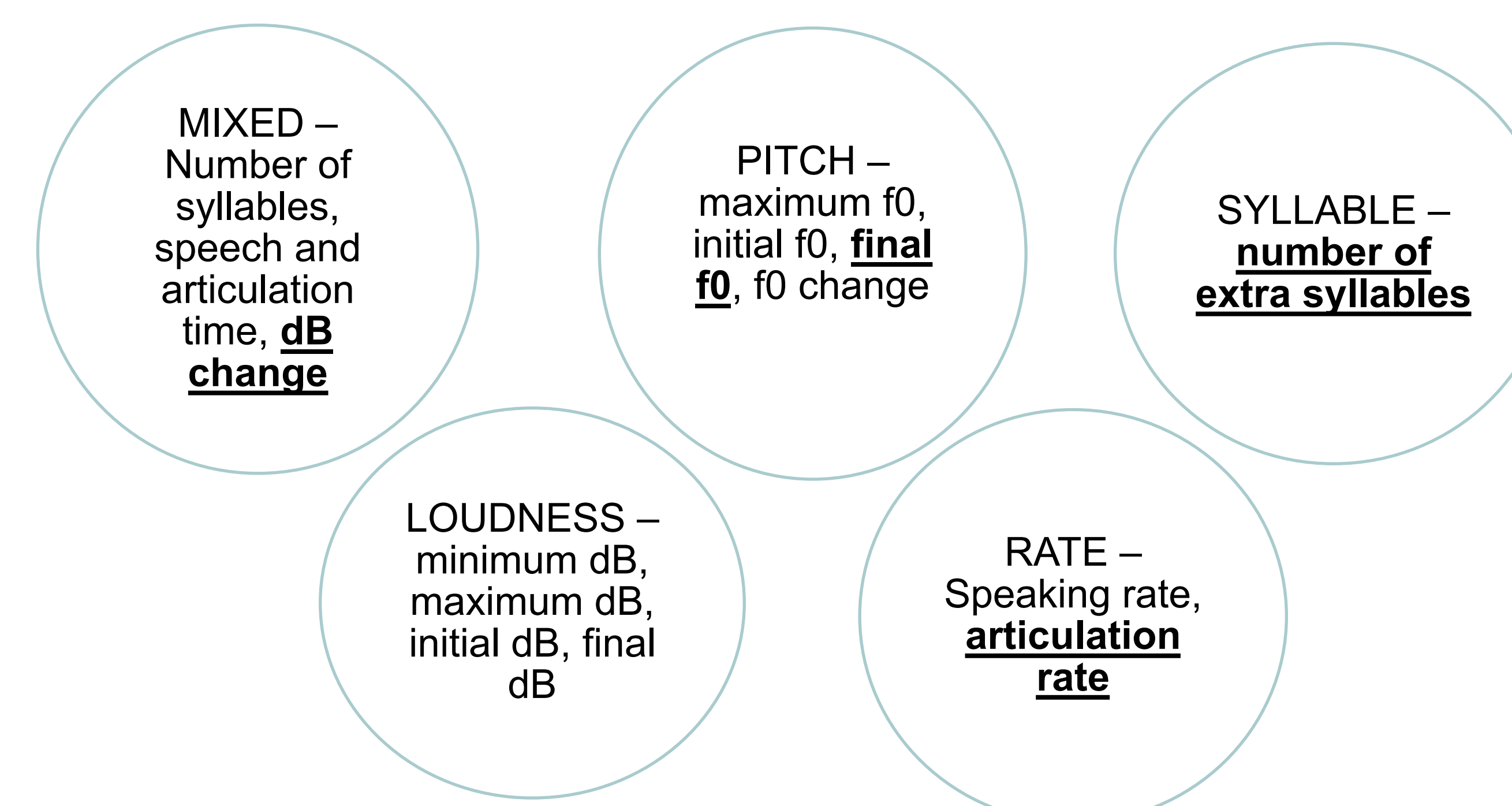
The utterances were then analyzed using Praat software (Boersma & Weenink, 2017) using a set of measures that previous studies may reveal prosodic differences among the speaker groups.

Analysis – The acoustic measures were analyzed using a principal component analysis to determine the separate factors and grouping of the acoustic measures, a regression model to determine the acoustic measures representing unique aspect of the variance across the dementia types, and a Mahalanobis distance measure for multivariate ANOVA to determine how well the factors discriminated among the dementia types.

Results

factors accounted for 67% of the overall variance

Item	1	2	3	4	5
Eigenvalues	5.542	4.322	2.469	2.145	1.686
Variance Percentage	23.093	18.009	10.289	8.936	7.024



Conclusions

The finding of speech acoustics differences between dementia types supports previous research findings,, including the importance of fundamental frequency related features (Gonzalez-Moreira et al., 2015; Meilán et al., 2012).

The research overall illuminated collinear variables within each factor and their associations with each other across the dementia types.

The factors from the principal component analysis were functional for differentiating among the speaker groups using the acoustic measures.

Future Directions

Future work with better recordings, more participants, and fewer dementia types should help in determining the functionality of these factors for differentially diagnosing dementia types.

References

Boersma, P., & Weenink, D. (2017). Praat: Doing phonetics by computer [Computer program]. Version 6.0.29, retrieved 24 May 2017 from <http://www.praat.org/>

Gonzalez-Moreira, E., Torres-Boza, D., Kairuz, H. A., Ferrer, C., Garcia-Zamora, M., Espinoza-Cuadros, F., & Hernandez-Gómez, L. A. (2015). Automatic Prosodic Analysis to Identify Mild Dementia. *BioMed Research International*, 2015, 916356. <https://doi.org/10.1155/2015/916356>

Meilán, J. J. G., Martínez-Sánchez, F., Carro, J., López, D. E., Millian-Morell, L., & Arana, J. M. (2014). Speech in Alzheimer's disease: Can temporal and acoustic parameters discriminate dementia? *Dementia and Geriatric Cognitive Disorders*, 37(5-6), 327–334.

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