Introduction

- Rate reduction is a popular management strategy in treatment of hypokinetic dysarthria (Yorkston et al., 2007).
- However, not all speakers with dysarthria exhibit improved speech intelligibility when reducing rate (Tjaden et al., 2014).
- Research on the effects of rate changes on stability of sentence-length speech motor movements in dysarthria is sparse and contradictory, with findings of:
  - increased variability at slow rate (Kleinow et al., 2001).
  - increased variability at fast rate (McHenry, 2003).
- Most speech variability research is based on kinematic data, but new techniques enable the assessment of variability of acoustic properties as an indirect measure of speech movement stability (Anderson et al., 2008).

Methods

- **Participants**: 23 speakers with PD and mild-moderate hypokinetic dysarthria (3) (20 male, 5 female, age 40-81, M = 66.6, SD = 10.6).
- **9 speakers with various neurological diseases and mild-severe ataxic/ataxic-spastic dysarthria (AD)** (3 male, 6 female, age 37-70, M=57.4, SD=13.9).
- **27 age-matched control speakers (CON)** (16 male, 11 female, age 35-80, M=57.4, SD=13.9).

Speech Tasks: Variability Measures

- Repeat the phrase "Tony knew you were lying in bed" as similar as possible, around 20 times.
  - Three speaking conditions:
    - Habitual rate (Hab)
    - Slow rate (Slow)
    - Fast rate (Fast)
- Acoustic properties of interest:
  - Sound pressure level (SPL)
  - Fundamental Frequency (F0)
  - First Formant (F1)
- Measures extracted with Functional Data Analysis:
  - Spatial Variability
  - Temporal Variability

Speech Tasks: Intelligibility Measures

- Engage in a monologue.
- Perceptual judgements (Likert-scaled ratings of intelligibility and listening effort) by 15 undergraduate SLP students, some experience in listening to dysarthric speech.

Summary & Conclusion

- Variability generally higher in dysarthria compared to controls.
- Higher severity in AD group reflected in higher variability.
- Rate differences dependent on group, task, speech parameter under investigation.
  - Deviating from habitual rate increases variability.
- AD: slow rate more impact on variability.
- Increased variability correlated with lower intelligibility ratings; shows potential as an acoustic measure of severity.
- Group differences of variability not always reflected in significant intelligibility-variability correlations.
- Complicated relationship acoustic variability - intelligibility; associations largely dependent on dysarthria type and speech parameter.

References


Acoustic Variability in Dysarthria: Effects of Articulation Rate and its Relationship with Intelligibility

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Data Analysis (example: SPL contours)

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Results: Groups & Tasks

- **Sound Pressure Level**
  - Overall: AD > HD = CON
  - Group comparisons:
    - Hab: Slow, Fast: AD = HD = CON
  - Task comparisons:
    - AD: Hab = Slow = Fast
    - HD: Slow = Fast = Hab
    - CON: Hab = Slow = Fast

- **Fundamental Frequency**
  - Overall: AD > HD = CON
  - Group comparisons:
    - Hab: Slow, Fast: AD = HD = CON
    - Fast: AD = HD = CON
  - Task comparisons:
    - AD: Slow > Fast = Hab
    - HD: Hab = Slow > Fast
    - CON: Slow = Fast > Hab

- **First Formant**
  - Overall: AD > HD = CON
  - Group comparisons:
    - Hab: Slow, Fast: AD = HD = CON
    - Fast: AD = HD = CON
  - Task comparisons:
    - AD: Slow > Fast = Hab
    - HD: Hab = Slow > Fast
    - CON: Slow = Fast > Hab

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