

# Perception of Audible Nasal Emission in Speakers with Cleft Palate: A Comparative Study of Rating Technique

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# Listener Judgments of Hypernasality and Audible Nasal Emission (ANE)

- Influence decisions regarding
  - Adequacy of velopharyngeal closure for speech
  - Assessment/Comparison of speech outcomes
- Interval scale ratings
  - Most common method for rating hypernasality and ANE in persons with cleft palate (Kuehn and Moller, 2000).
- Direct Magnitude Estimation
  - May result in a more valid and reliable rating of hypernasality than interval scaling (Zraick and Liss, 2000; Whitehill et al., 2002; McHenry, 1999).
  - ANE?



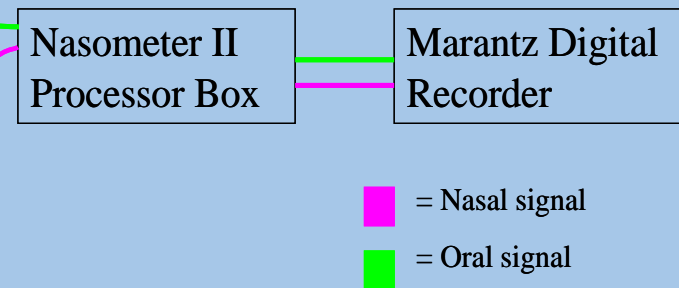
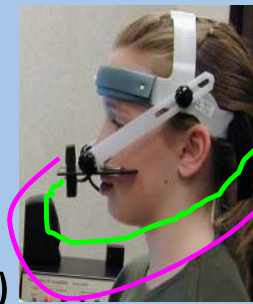
# Purpose of the Study

1. To determine which rating technique, interval scaling or direct magnitude estimation, demonstrates stronger construct validity and reliability for judgments of audible nasal emission (ANE), and
2. To explore factors associated with listener perceptions of the severity of ANE in speakers with cleft palate.



# Method

- Speakers:
  - 6 adolescents with a history of cleft palate
    - Audible nasal emission in connected speech
    - Excluded speakers with phoneme-specific ANE
  - Speech recordings
- Occurrences of ANE identified in the nasal signal using visual and auditory cues
- Acoustic analysis of ANE (*Praat*)
- Digital manipulation of ANE: 4 stimulus conditions (*Cool Edit Pro*)
  - 1 control condition, 3 “amplification” conditions
    - +5, +10, and -96dB (“no ANE condition”)



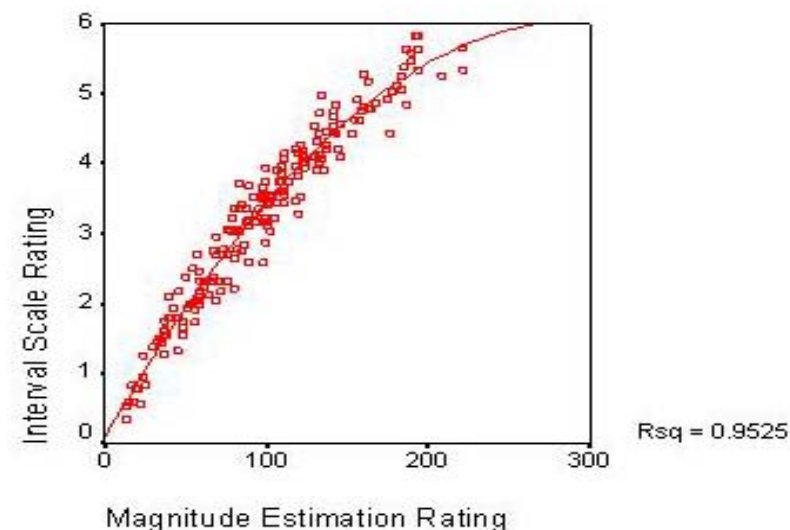
# Method

- 31 trained adult listeners
  - Listening tasks (*E-Prime*): Rate severity of ANE
    - Interval scaling (7 point scale)
    - Direct Magnitude Estimation-without modulus
- **Data analysis** (Lane et al., 1961; Kalikow, 1967; Engen, 1971; Stevens, 1975)
  - Arithmetic mean (for interval scale ratings) and geometric mean (for modulus-equalized magnitude estimation ratings) were plotted against each other
    - Progressively higher order polynomials fit to the data
    - Linear→metathetic (quality), Curvilinear→prothetic (quantity)
  - Regression analysis: factors associated with ANE



# Results

- Validity
  - Curvilinear relationship best fit the data ( $p < 0.001$ ) → suggests that ANE is a prosthetic continua and direct magnitude estimation is the rating method with stronger validity.
- Reliability:
  - Direct magnitude estimation:
    - Intralistener: Pearson's  $r = 0.80$
    - Interlistener: ICC  $r = 0.79$
  - Interval Scale Ratings
    - Intralistener: Spearman's  $\rho = 0.59$
    - Interlistener: ICC  $r = 0.53$
- Significant predictors of ratings of severity of ANE:
  - intensity of ANE,
  - number of occurrences of ANE, and
  - spectral slope (all  $p < 0.001$ ).

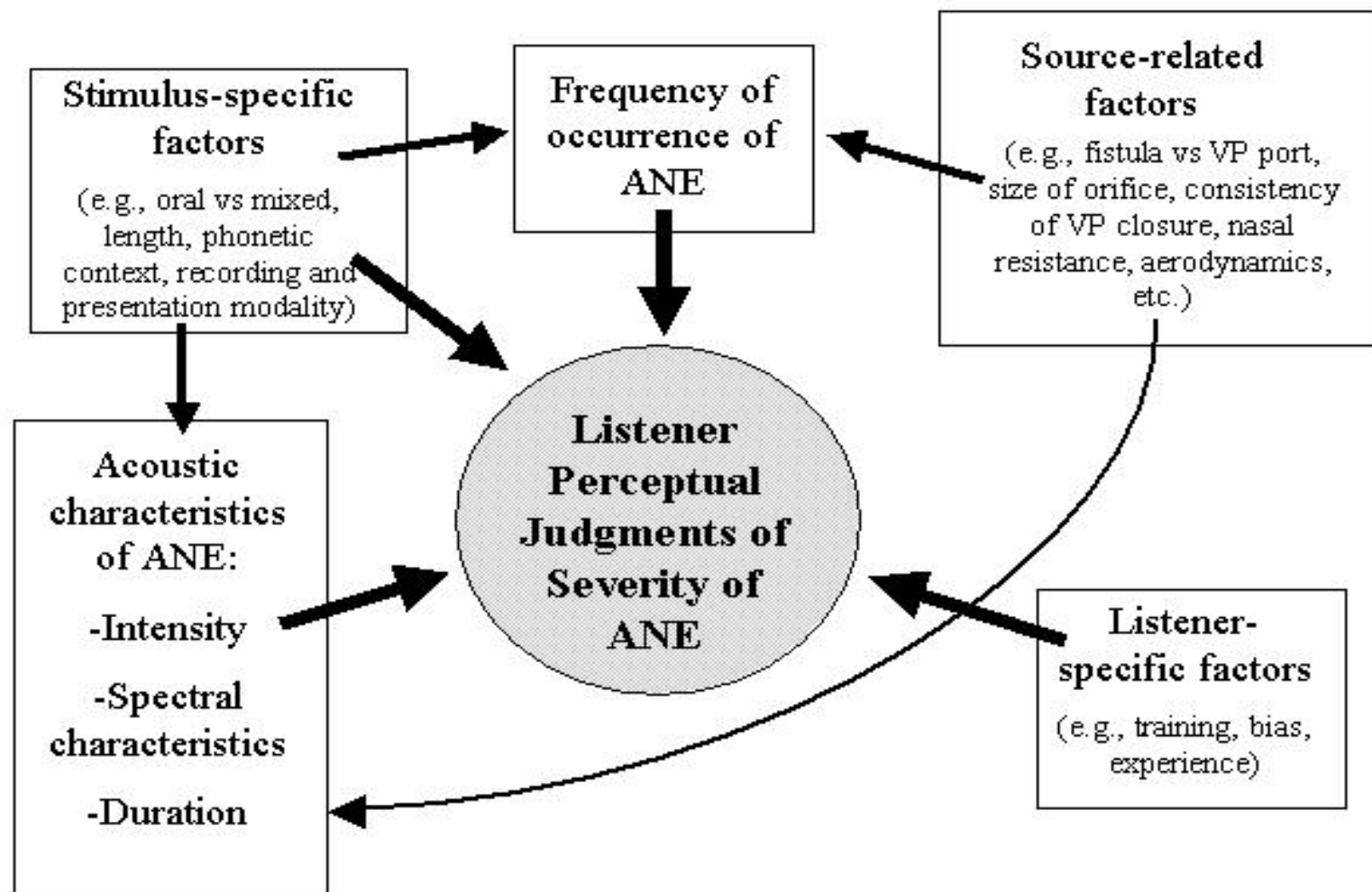


Curvilinear (quadratic) fit,  $r^2 = 0.9525$

# Conclusions

- The results of this study parallel those found for listener ratings of hypernasality (Whitehill et al., 2002; Zraick and Liss, 2000)
- Application of magnitude estimation or other ratio-based rating techniques (e.g., VAS) for perceptual judgments of speech in persons with cleft palate should continue to be explored.
- Future research should continue to identify factors which influence listener perceptions of the severity of ANE.







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