Automated Acoustic Analysis of Affective and Pragmatic Prosody in ASD

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Background

- ASD associated with deficits in affective and pragmatic prosody.
- Examiner's evaluation of prosody subject to influence from factors such as subject's current mood, spontaneous use of prosody, and suspected diagnosis.
- Biases potentially moderated with scores from automated analysis of acoustic features that yields results similar to those produced in a "blind" assessment.

Objectives

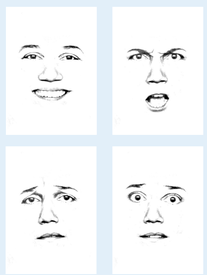
- Ascertain reliability of assessment of prosody expressing affect and pragmatic style.
- Determine whether complex automated measures of acoustic features can accurately identify different affects and styles.
- Explore the ability of various scores to distinguish TD subjects from subjects with ASD.

Method

Data

Speakers

- 15 ASD, 13 TD, 15 meeting some but not all criteria for ASD.
- Age 4-8, performance IQ > 70.



Prosodic Tasks

1. *Affect*: Repeat phrase with one of four affects (happy, angry, sad, fearful).
2. *Pragmatic Style*: Use appropriate prosody while talking to an adult or baby [1].

Scoring

Real-time examiner scores

One of 4 clinicians immediately assessed the correctness of each response during examination, yielding *real-time examiner scores*.

Randomized perceptual experiment

Affect: Six naive judges listened to an utterance and selected the perceived affect from a list of four (happy, angry, sad, fearful), along with their confidence in their selection.

Pragmatic Style: Six naive judges listened to recordings of minimal pairs of responses and selected the infant-directed utterance and confidence in their selection.

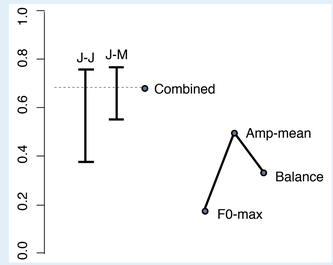
Automated analysis

- Quantitative features based on *pitch (F0), energy (amplitude), and spectral balance* were computed from recordings of the children's responses.
- Multiple measures were *combined using multiple linear regression* to create a single complex score for each utterance or utterance pair.

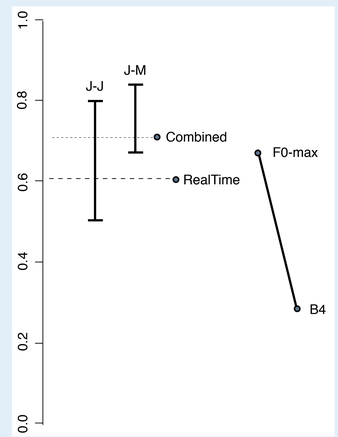
Results

Correlations

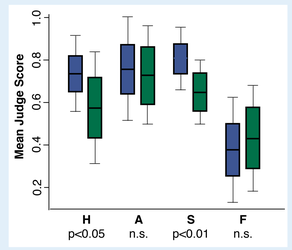
Affect

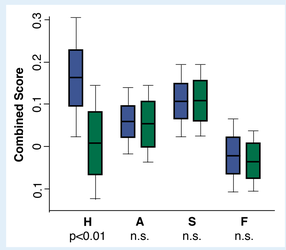


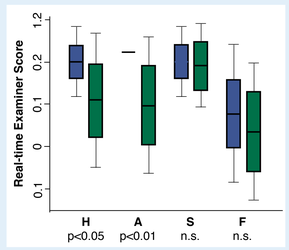
Pragmatic Style

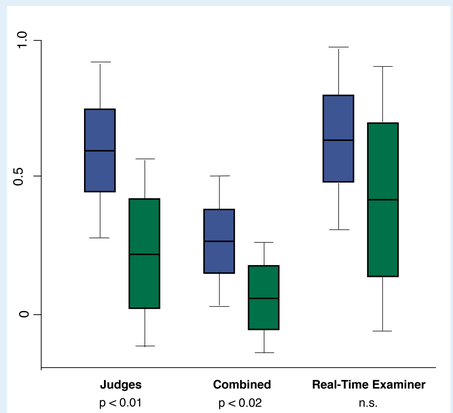


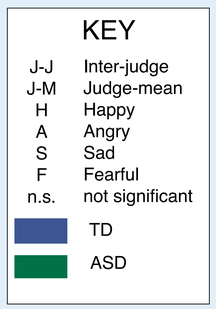
Group Differences











Conclusions

- Combined objective acoustic measures of affect and pragmatic style expression were comparable in reliability to "blind" subjective scores in accuracy.
- Objective scores also superior to real-time clinical judgments in terms of accuracy and ability to distinguish between the two diagnostic groups.
- Results show potential for enhancing reliability of clinical assessment of prosody using automated objective measures of acoustic features.

References & Sponsors

[1] Paul, R., Augustyn, A., Klin, A., Volkmar, F., 2005. Perception and production of prosody by speakers with autism spectrum disorders. Journal of Autism and Developmental Disorders, 35, 201-220.

NIH 1R01DC007129 (van Santen, PI); Autism Speaks: Mentor-based Fellowship (Prud'hommeaux); Autism Speaks: Computerized Interactive Game for Remediation of Prosody in Children with Autism (Black, PI); Autism Speaks: ITA: Automated Measurement of Dialogue Structure in Autism (Roark, PI).