Effects of Autistic Traits on Acoustic Measures of Vowel Dispersion
Alexandra Diaz, Maha Elcharfa, & Krissy Dellecave

Abstract
Previous research has shown that measures of speech production and speech perception vary systematically in relation to neurotypical autistic traits, i.e., characteristics associated with the broad autism phenotype (BAP). In the present study, we continue investigating the role that autistic traits play in speech production in communicative contexts. A large group of American English speakers produced words containing four corner vowels [ɪ, ɛ, ə, u], from which we calculated acoustic measures of vowel distinctiveness. The goal of this second stage of research was to confirm the existence of differences related to sex, as autistic traits have sometimes been found to have a stronger relationship with speech variables for female speakers relative to male speakers.

1. Introduction

Definition of language and communication are defining characteristics of autism spectrum disorders (ASDs). Deficits in language and communication are defining characteristics of autism spectrum disorders (ASDs).2

Differences in speech perception and language comprehension have also been reported in neurotypical populations in relation to autistic traits.3

Autistic traits: measureable personality traits that resemble mild versions of behavioral and information processing patterns associated with ASDs.

While less is known about speech production, speakers with higher levels of autistic traits may produce less communicative/less clear speech.

RESEARCH QUESTIONS
• Do autistic traits influence vowel production?
• Is there an interaction with speaker sex? (Our first analysis suggested “yes”).

HYPOTHESIS
• Speakers with higher levels of autistic traits will produce vowels that are less distinct acoustically – possibly more so for women.

2. Methods

The data we present here are from a study in which 78 speakers of American English produced words or pseudowords with different vowels. We then measured the frequencies of the first and second formants (F1 and F2) for each vowel produced using the acoustic analysis software PRAAT.

Formants are bands of energy in certain frequency regions; different vowels have formants in different frequency regions.

Figure 1: Acoustic space based on the first and second formant frequencies of four American English vowels.

Figure 2: Example sentence highlighting the locations of F1 and F2 in the word “head”,

The words we present here are from a study in which 78 speakers of American English produced words or pseudowords with different vowels.

The words were assessed in low predictability sentence contexts, occurring either early or late in the sentence:
• E.g. The first word is “head…”, and “head is the first word…”

The words contained the vowels at the extremes of the vowel space: [ɪ], [ɛ], [ə], [u]. The basic idea is that speakers with more distinct/extreme vowels have larger spaces; speakers with less clear, less distinct vowels have smaller spaces:

Heed [ɪ]
Head [ɛ]
Who’d [u]
Hod [ə]

Figure 3: Correlations between vowel space size and scores on the Pragmatic Language subscale of the Broad Autism Phenotype Questionnaire (BAPQ), a measure of Autistic Traits in neurotypical individuals. Only the correlation for female speakers is significant (p < 0.1).

3. Results

Analysis of these 74 speakers confirms the results of our previous analysis of a smaller data set:

Neurotypical autistic traits are predictive of vowel distinctiveness, but only for female speakers.

• Female speakers with higher autistic trait load (i.e. with more autistic-like personalities as measured by the BAPQ) produce smaller, less dispersed vowel spaces (and thus less acoustically distinct vowels).

Why are autistic traits only relevant for female speakers’ vowel production?

• It remains unclear – just as it does for the clinical population.

• One possibility is that this pattern reflects difficulties in measuring autistic traits in women; women with autism are known to engage in more “camouflaging” of autism symptomology than men with autism. Possibly our BAPQ scores for women actually reflect much higher “real” scores due to such camouflage.

• However, the results are also consistent with the idea of sex-specific autism phenotypes, with differences in language and communication defining the female phenotype.4

4. Discussion & Conclusion

5. References