

Talker gender effects in the Ferguson Clear Speech Database

Sarah Hargus Ferguson, *Department of Communication Sciences and Disorders, University of Utah, Salt Lake City, Utah*

Shae D. Morgan, *Department of Communication Sciences and Disorders, University of Utah, Salt Lake City, Utah*



Background

The **Ferguson Clear Speech Database** was developed at Indiana University with the goal of using **natural talker variability** to help uncover **what makes clear speech clear**. The database consist of **41 untrained talkers (21 women and 20 men)** recruited into four age groups (18-24, 25-31, 32-38, and 39-45). All talkers were speakers of the South Midland Dialect.

Talkers read **188 sentences** under instructions to speak in a **conversational (CON)** manner and as though they were talking to a listener with a hearing impairment. The latter condition is considered **clear (CL)** speech.

Of the 188 sentences, 14 were selected from the **CID Everyday Sentences Test** (a **different set of 14 in each style**). The remaining 174 "keyword" sentences were composed by inserting **keywords** into one of 16 neutral sentence frames (e.g., "Please put the bid on the table."). The keywords for each speaking style contained **70 /bVd/ words (7 tokens each of 10 vowels in /bVd/ context)** and 104 monosyllabic words (2 tokens each of a 50-item NU-6 test list plus two additional monosyllabic words containing the vowel /u/). A different list of 52 words was recorded in each speaking style.

Several studies have been carried out in which **perceptual data** were collected for **all 41 talkers**; data on **talker gender effects** are reported here from three of these studies.

While a few previous studies have examined talker gender effects for young adults with normal hearing, **no work prior to the studies report here** has compared perceptual characteristics of male versus female talkers for older adults with hearing loss. This is surprising given how frequently audiologists hear their patients complain about **particular difficulty understanding female talkers**. The idea that women are harder to understand than men seems to be something that we in audiology "just know".

Acknowledgments

Development of the Ferguson Clear Speech Database was supported by National Institutes of Health (NIH) Grant R01 DC02229 to Diane Kewley-Port. Other research reported here was supported by NIH Grant R03 DC008866 to the first author and NIH Grant R01 012315 to Eric Hunter. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

Disclosures

Neither Dr. Ferguson nor Mr. Morgan has any relevant financial or nonfinancial relationships to disclose.

YNH listener data

Vowel identification in noise

- Ferguson (2004)
 - 7 young adults with normal hearing (YNH listeners)
 - /bVd/ words (2 tokens per vowel per style per talker)
 - 70 dB SPL
 - Mixed with 12-talker babble; SNR: -10 dB
- Analyzed using mixed ANOVA:
 - Significant **style** and **talker gender** effects, significant **interaction**
 - Larger clear speech effect for females than males (11 vs. 6 percentage points)
 - Females more intelligible than males, but only in clear speech

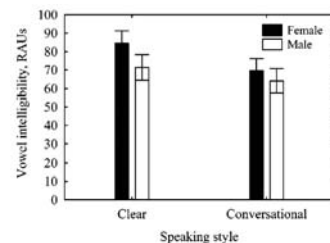
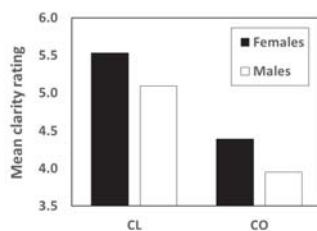


FIG. 4. Overall RAU vowel intelligibility in clear and conversational speech for male and female talkers.

Perceived clarity

- Ferguson & Morgan (in preparation)
 - 21 YNH listeners
 - CID Everyday Sentences (14 in each style from each talker)
 - Comfortable presentation level
 - Rated clarity on a Likert scale from 1-7
- Analyzed using mixed-effects ordered logistic regression models with listener and talker as random effects:
 - Significant **style** and **gender** effects, significant **interaction**
 - Style effect was significant for both men and women
 - Females were rated clearer than males, in both styles

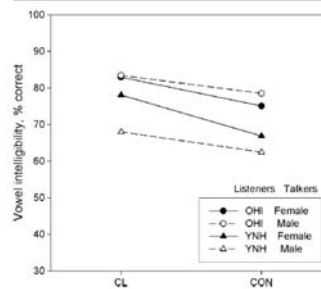


OHI listener data

Vowel identification in noise

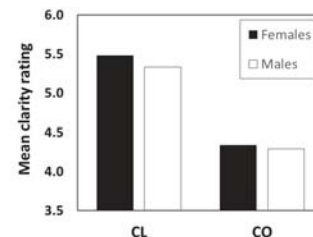
- Ferguson (2012)
 - 40 older adults with mild-to-moderately severe sloping sensorineural hearing loss (OHI listeners)
 - Same materials and presentation level as YNH listeners
 - Mixed with 12-talker babble; SNR: -3 dB
- Analyzed using linear mixed-effects models:
 - Significant **style** effect, n.s. **talker gender** effect, significant **interaction**
 - Larger clear speech effect for females than males (10.8 vs. 7 RAU)
 - Talker gender effect was not significant in either style

Figure 3. Percent correct intelligibility for clear (CL) and conversational (CON) vowels produced by female and male talkers, as identified by older adults with hearing impairment (OHI listeners) in the present study and by young listeners with normal hearing (YNH) in Ferguson (2004).



Perceived clarity

- Ferguson & Morgan (in preparation)
 - 15 OHI listeners
 - Same materials, procedures, and statistical analyses as YNH listeners
- Same statistical analyses as for the YNH listeners:
 - Significant **style** effect, n.s. **talker gender** effect, significant **interaction**
 - The clear speech effect was larger for female talkers than for male talkers
 - The **talker gender effect was not significant** for either style



Discussion

The results for YNH listeners (superior vowel intelligibility and perceived clarity for **female** talkers) are consistent with other studies:

- Bradlow et al. (1996)
 - Harvard sentences, quiet;
 - F: ~90%, M: ~86%
- Hazan and Markham (2004)
 - CVC words, 20-talker babble, +6 dB SNR
 - F: ~96 RAU, M: ~93 RAU

In contrast, for OHI listeners, male and female talkers are similarly intelligible and clear

- Something about age and/or hearing loss seems to be nullifying the factors that make women more intelligible and clearer for YNH listeners

This similarity between male and female talkers differs from audiology patients' frequent complaints of **particular difficulty understanding female talkers**. What explains these complaints? Some thoughts:

- Female talkers may be quieter "in the wild" than male talkers
 - Experimental materials were all scaled to the same amplitude
- When our patients were young, they developed a **habit of using less effort when listening to female talkers**, a strategy which no longer works for them
- Test blocks in experiments always contained talkers of one gender
- The complaints we're hearing aren't general to all audiology patients but primarily to our **male patients AND**
- The complaints aren't about women generally but about **wives**

What do you think?

References

- Bradlow, A. R., Torretta, G. M., & Pisoni, D. B. (1996). Intelligibility of normal speech I: Global and fine-grained acoustic-phonetic talker characteristics. *Speech Communication*, 20, 255-272.
- Ferguson, S. H. (2004). Talker differences in clear and conversational speech: Vowel intelligibility for normal-hearing listeners. *Journal of the Acoustical Society of America*, 116, 2365-2373.
- Ferguson, S. H. (2012). Talker differences in clear and conversational speech: Vowel intelligibility for older adults with hearing loss. *Journal of Speech, Language, and Hearing Research*, 55, 779-790.
- Ferguson, S.H., & Morgan, S.D. Acoustic and perceptual correlates of subjectively rated sentence clarity in clear and conversational speech. In preparation for the *Journal of Speech, Language, and Hearing Research*.
- Hazan, V., & Markham, D. (2004). Acoustic-phonetic correlates of talker intelligibility for adults and children. *Journal of the Acoustical Society of America*, 116, 3108-3118.