

Talker differences in clear and conversational speech: Subjective ratings of sentence clarity

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September 10, 2012

Acknowledgments

- Current project
 - NIDCD-R03-08886 (PI: me) and U of U
- Development of Ferguson database
 - NIDCD-R01-02229 (PI: D. Kewley-Port)
- U of U Speech-Language-Hearing Clinic
- Amanda Malone, Craig Berg, Patrick Pead
- Lydia Rogers

Clear speech

- The style of speech a talker produces when his or her **communication partner has a hearing loss**
- Elicited by having talkers **read written materials*** in two conditions
 - (1) In a **conversational** manner
 - (2) As if talking to **hearing-impaired listener**

Clear speech

- It's **more intelligible** than conversational speech (by ~10-35 percentage points)
- It **differs acoustically** from conversational speech
 - Reduced **speaking rate**
 - More **consonant energy**
 - Expanded **vowel space**

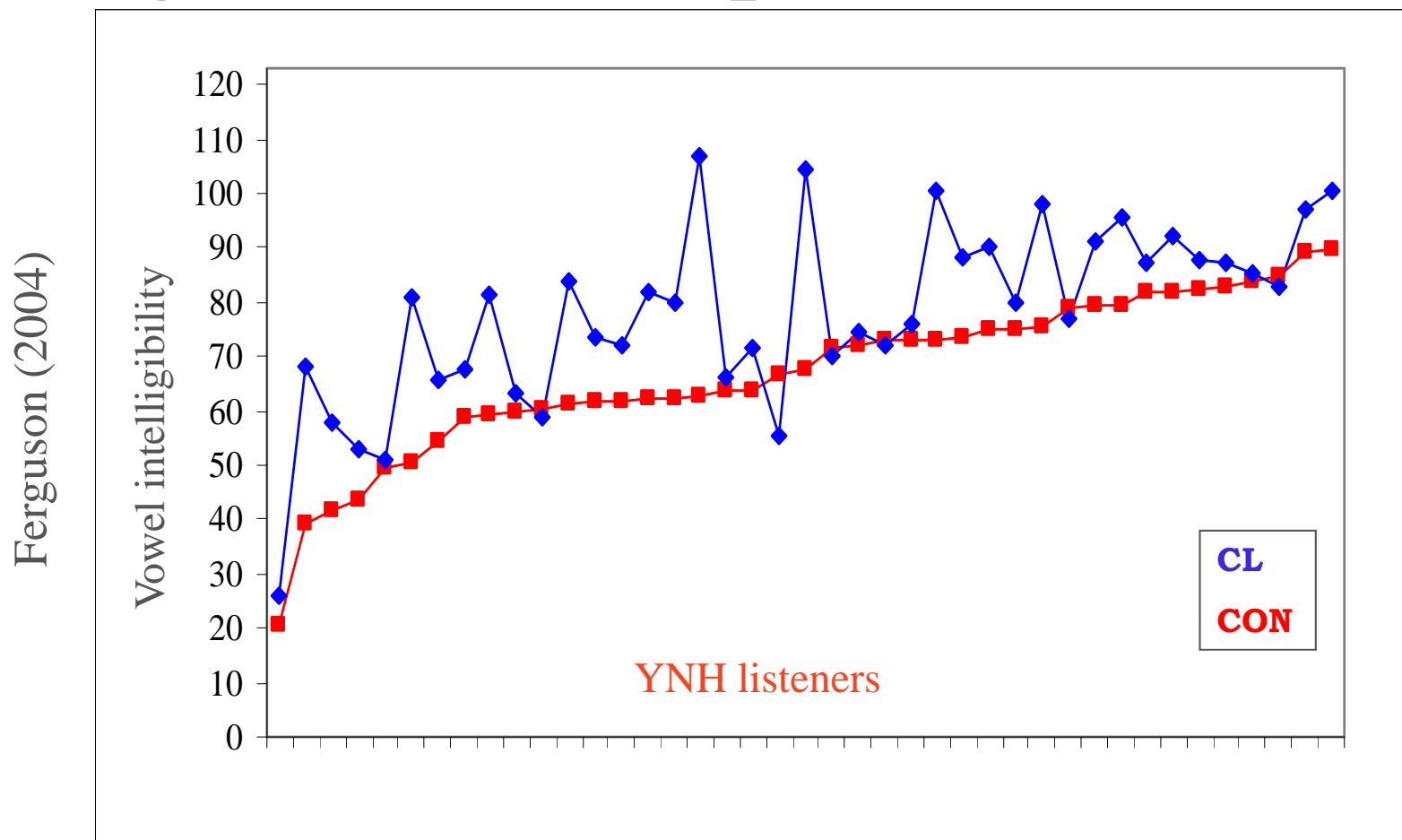
Ferguson Clear Speech Database

- 41 talkers reading **sentences** under conversational and clear instructions
 - **Keyword** sentences (/bVd/ and NU-6)
 - e.g., “Look up the word bid in the dictionary”
 - **CID Everyday Sentences**
 - 14 in each style ([PDF link](#))
 - Identical for all 41 talkers

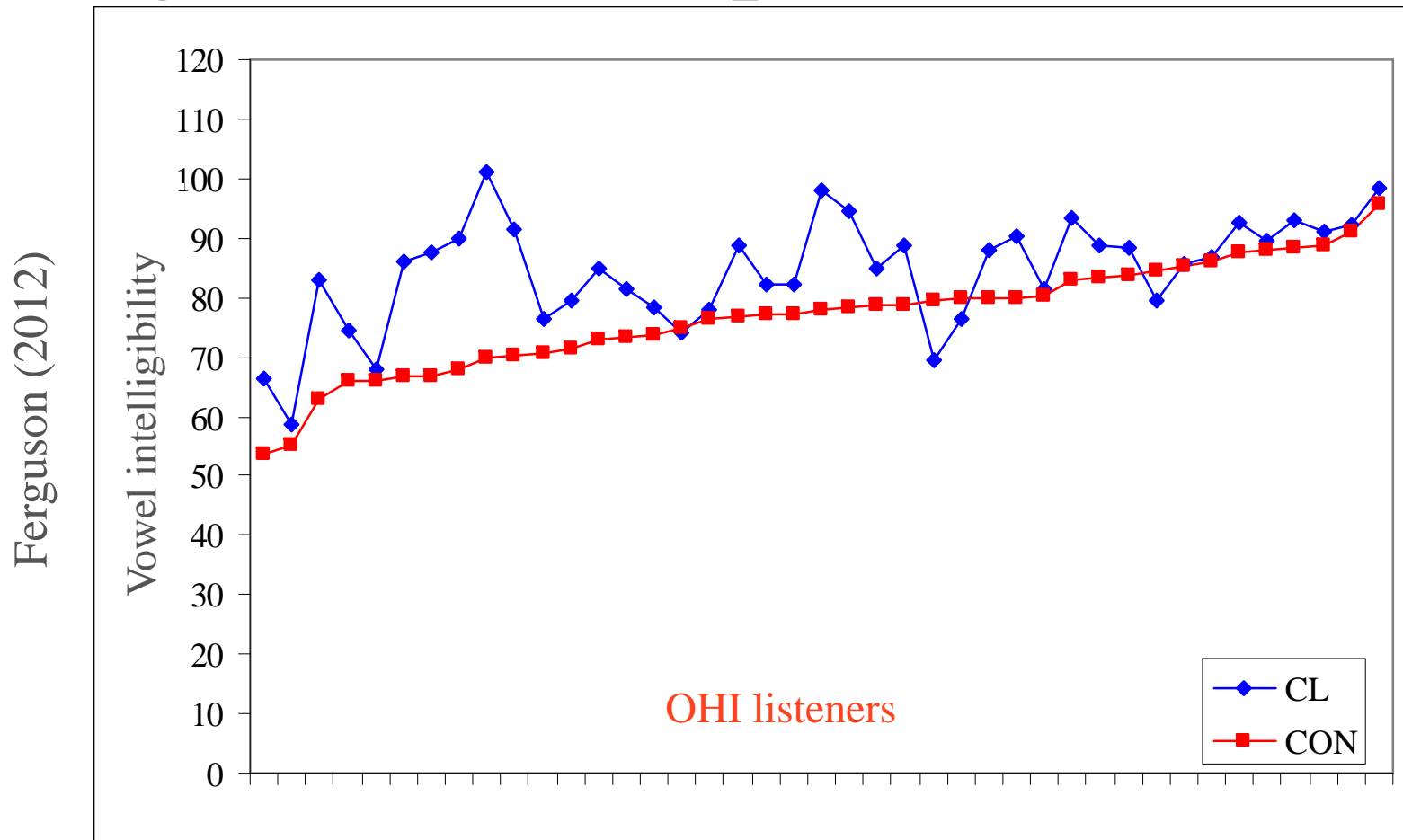
Ferguson Clear Speech Database

- Most work to date has examined **vowel intelligibility** and its **acoustic correlates**
- Among the 41 talkers:
 - **Vowel intelligibility in noise** varies widely within each speaking style
 - And so does the **clear speech vowel intelligibility benefit**

Ferguson Clear Speech Database

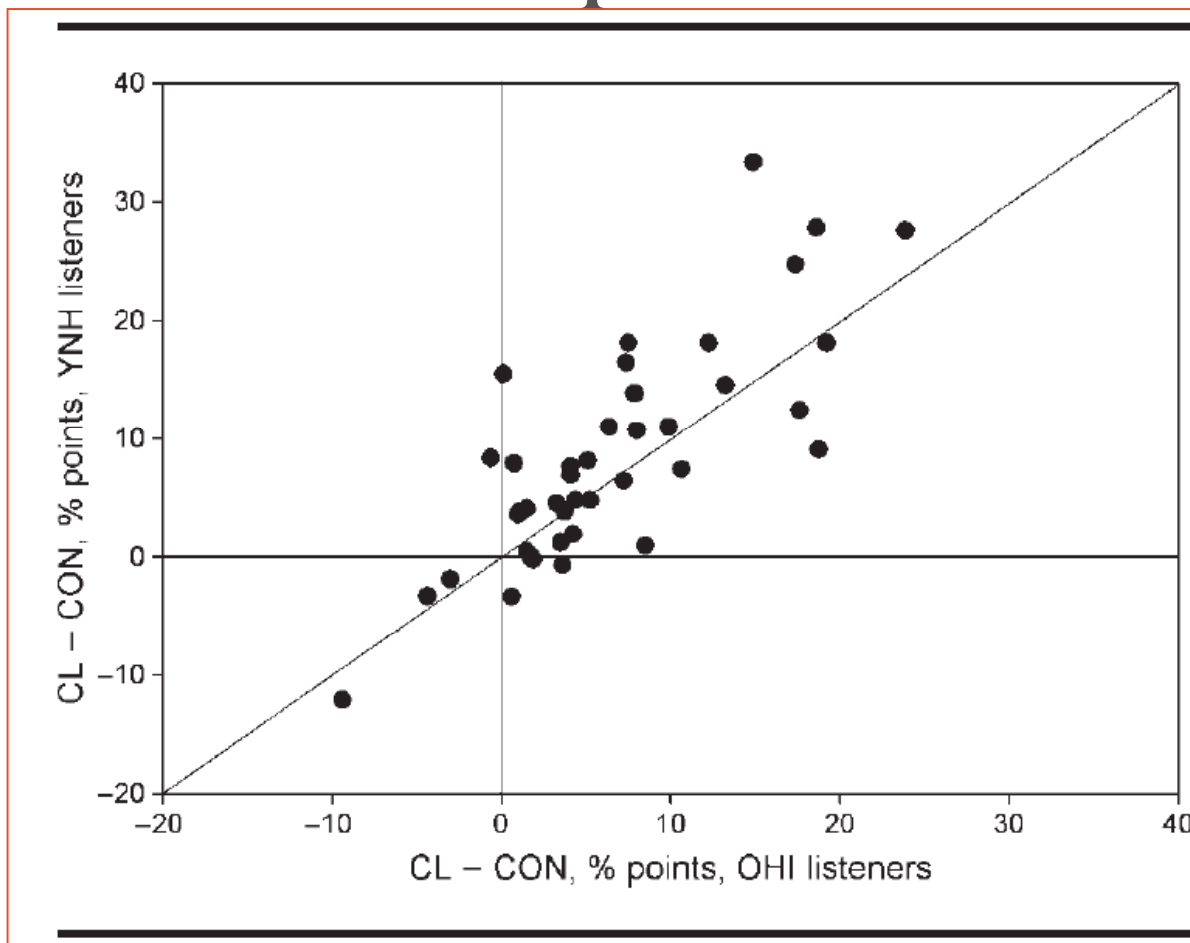


Ferguson Clear Speech Database



Ferguson Clear Speech Database

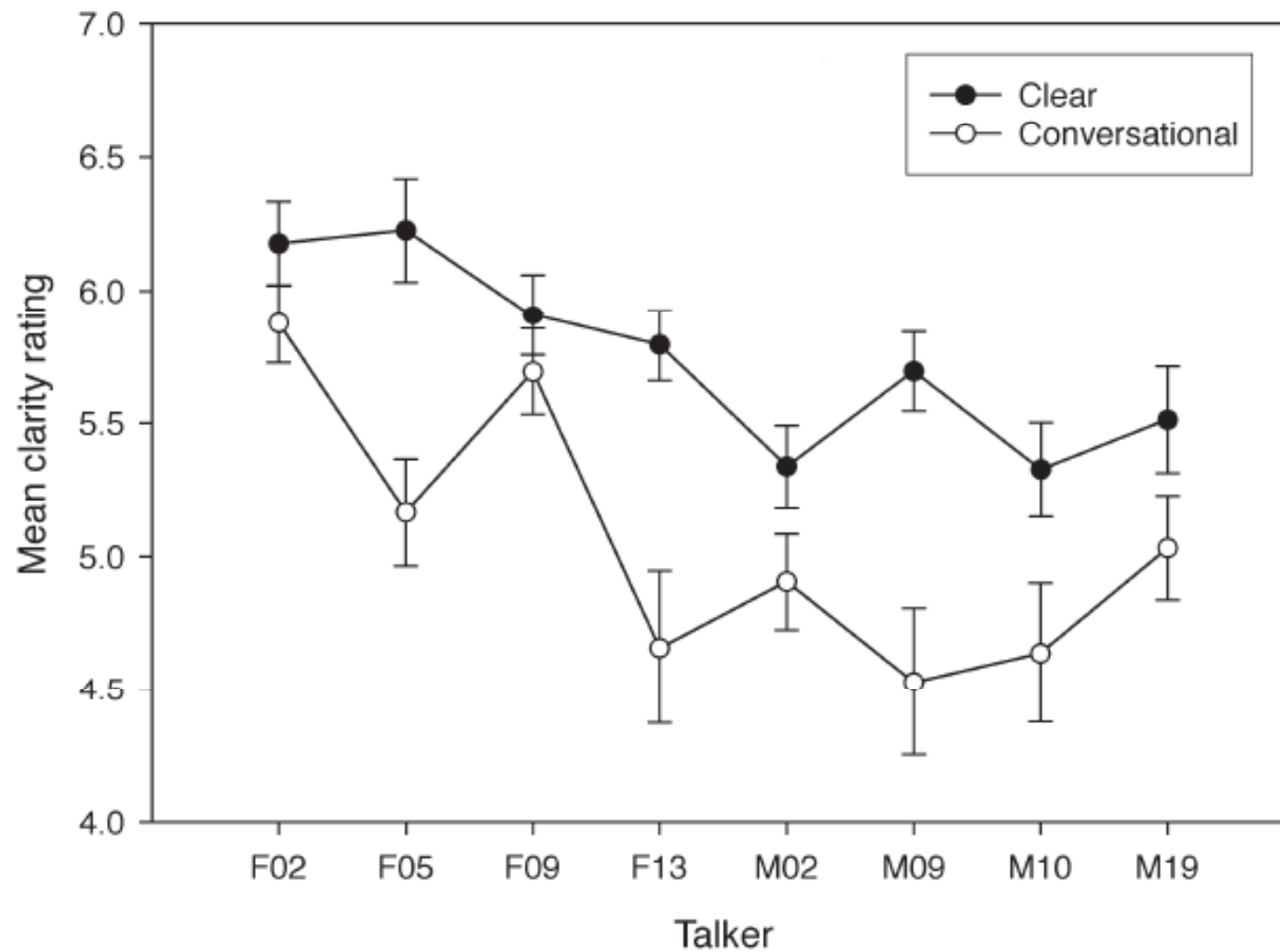
Ferguson (2012)



Ferguson Clear Speech Database

- **Sentence** materials are more **ecologically valid** but pose **methodological challenges**
- Ferguson & Kerr (2009) showed that **subjective ratings** yielded useful, valid data on speaking style effects and talker variability

Ferguson & Kerr (2009)



The current project

- Extended Ferguson & Kerr's approach to **all 41 talkers** and to **OHI listeners**
 - To establish **range of speech clarity differences** expected in a population of normal talkers, and how clarity relates to **talker characteristics**
 - To compare **YNH and OHI listeners**
 - To find **acoustic correlates** of sentence clarity

Methods: Materials

- **1148** CID Everyday Sentences, equated for RMS intensity
- Divided into **10 test blocks** arranged quasi-randomly **for each listener**, with roughly equal numbers of M and F talkers
 - 9 blocks of 112 sentences
 - 1 block of 140 sentences

Methods: Listeners

- 21 **young adults with normal hearing** (YNH listeners; screened at 20 dB HL, 250-8000 Hz)
- 15 **older adults with mild-to-moderately severe sloping sensorineural hearing loss** (OHI listeners)
- All were native speakers of American English

Methods: Procedures

- At each of **two test sessions**, listeners
 - **Studied** the list of sentences
 - Performed subjective ratings on a **practice block** of sentences
 - Performed subjective ratings on **5 test blocks**
- Sentences were presented monaurally in quiet at **70 dB SPL** via insert earphones

Methods: Rating scale

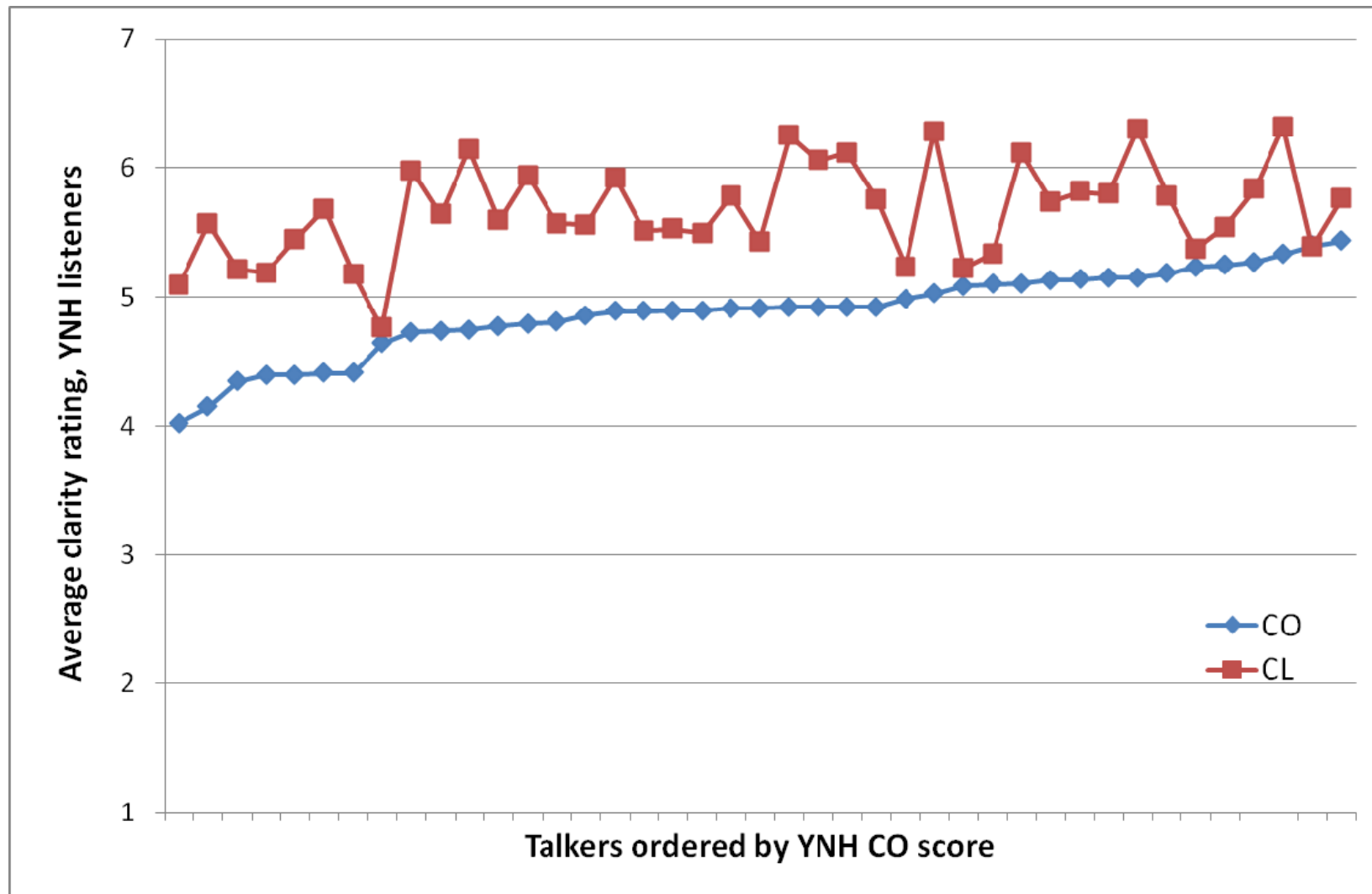
Category	Label
1	Minimum (lowest possible clarity)
2	Very unclear
3	Somewhat unclear
4	Midway
5	Somewhat clear
6	Very clear
7	Maximum (highest possible clarity)

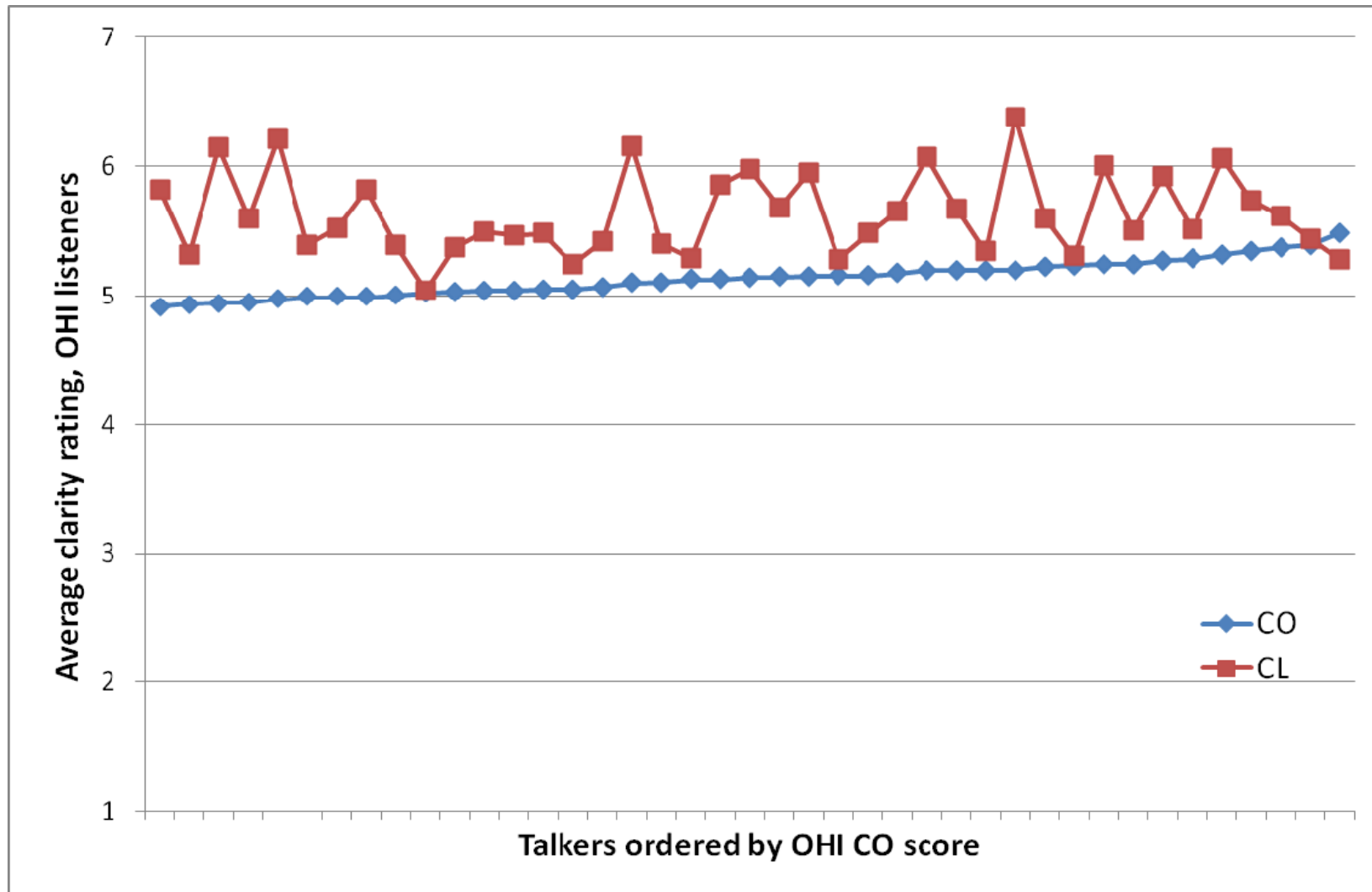
Preliminary data analysis

- Analyses here are **mixed ANOVAs*****
 - For analyses including **talker effects**, dependent variable was **individual listener ratings** for each talker
 - For analyses including **talker characteristics**, dependent variable was **average ratings by group** for each talker

Results

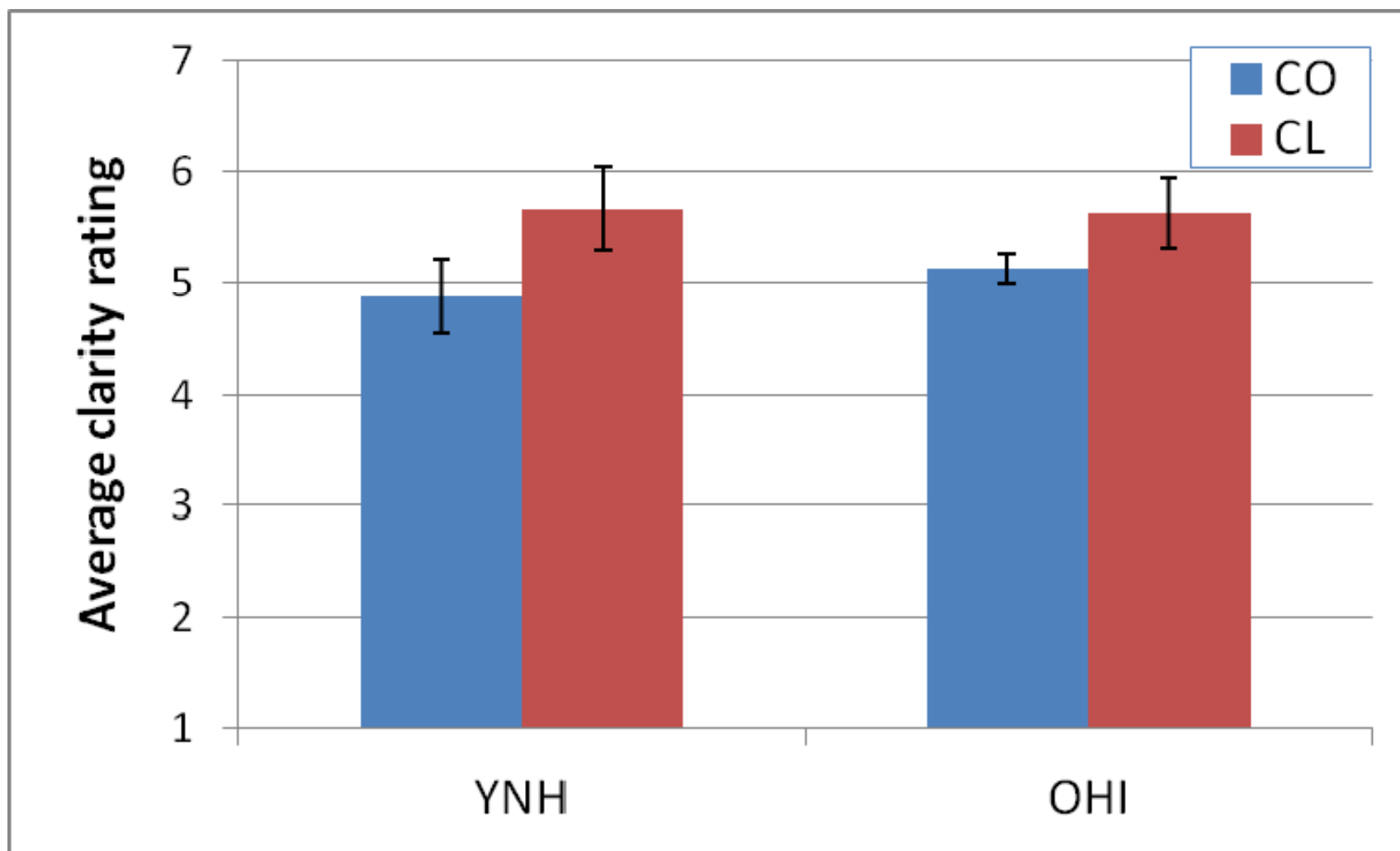
- 1st analysis: Examining effects of **talker**, **speaking style**, and **listener group**
- **Style** and **talker** factors were significant
- **Interaction** between talker and style was significant
 - BUT the talker factor **violated sphericity**
 - With **strict** correction, interaction is **NS**

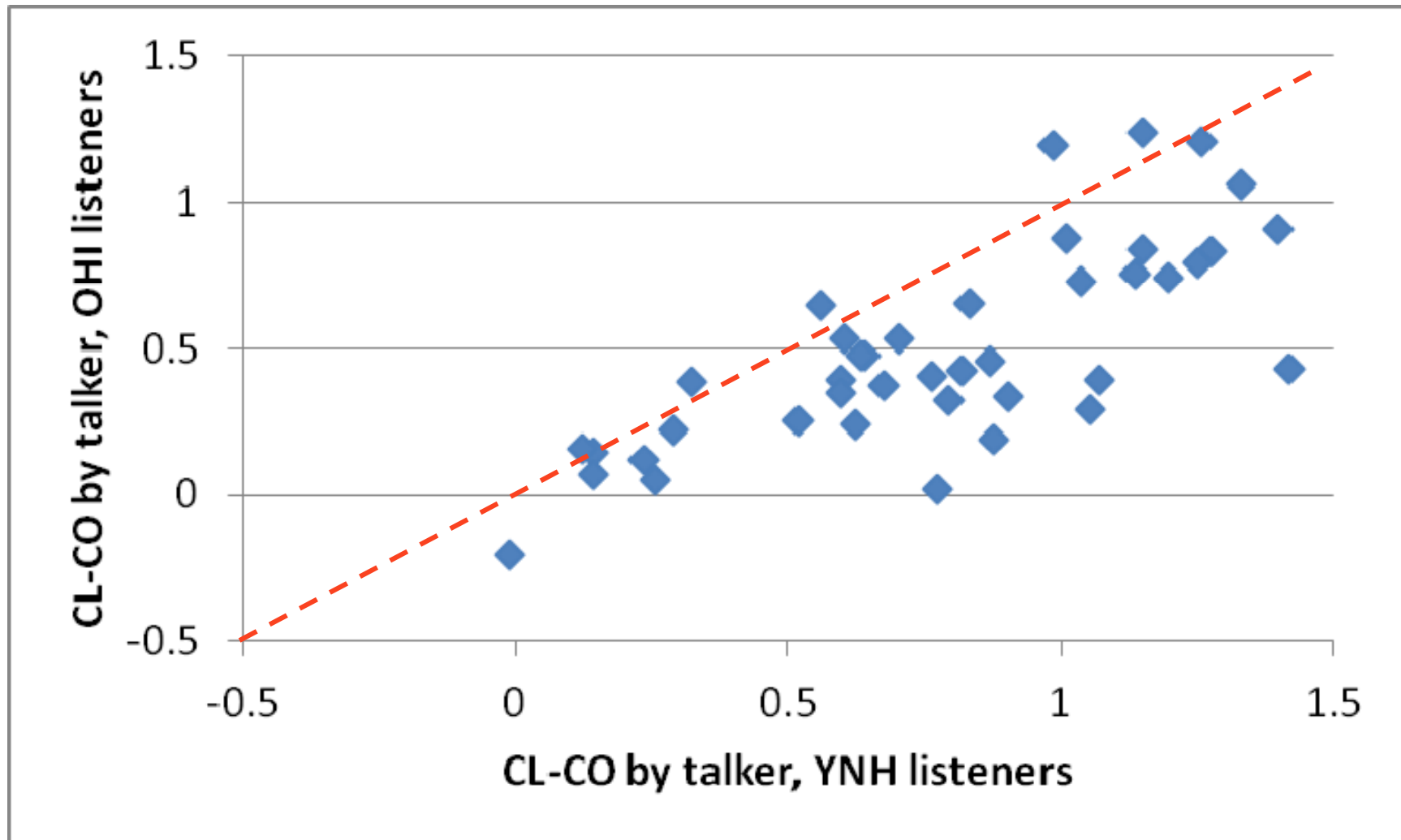




Results

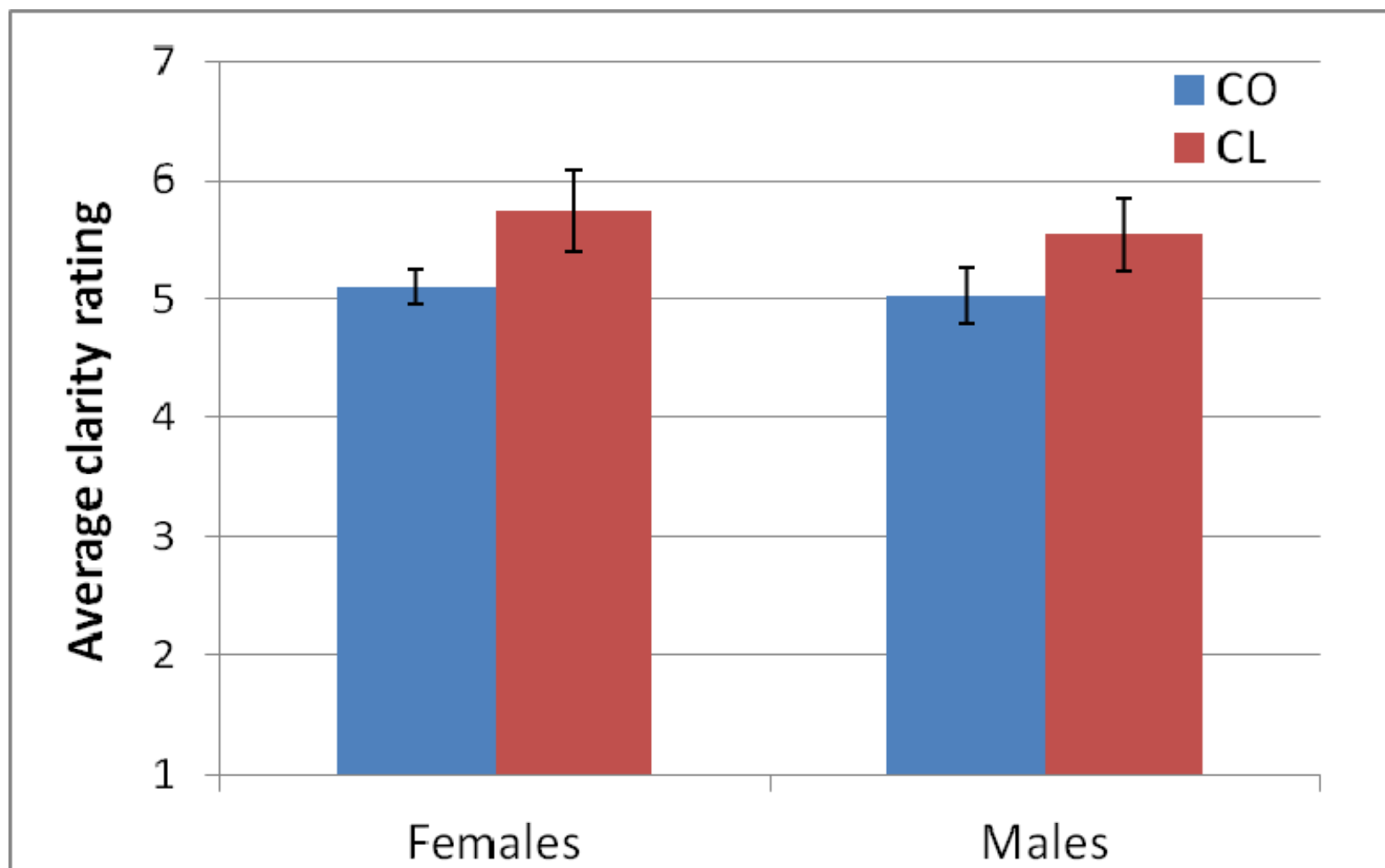
- **Listener group and the interaction between style and listener group** were not significant
- The **3-way interaction** between talker, style, and group was **significant**
 - **BUT it disappeared** when corrected for sphericity violation





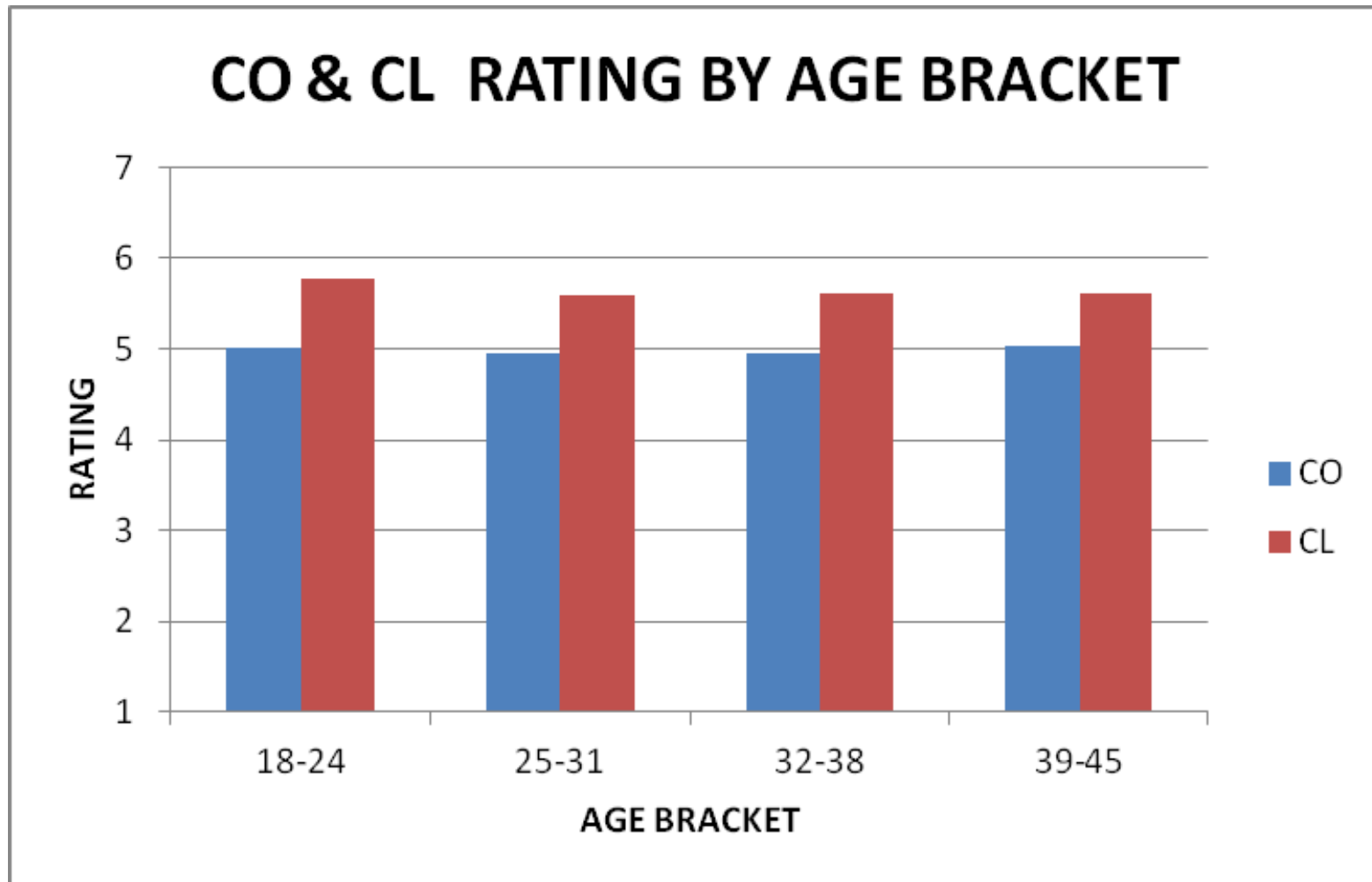
Results

- 2nd analysis: Examining effects of talker **characteristics, style, and listener group**
- Separate ANOVAs assessed talker **gender, age, and experience communicating with listeners with hearing loss** in
- Main effect of **gender** was **significant**, but it **didn't interact** with style or group

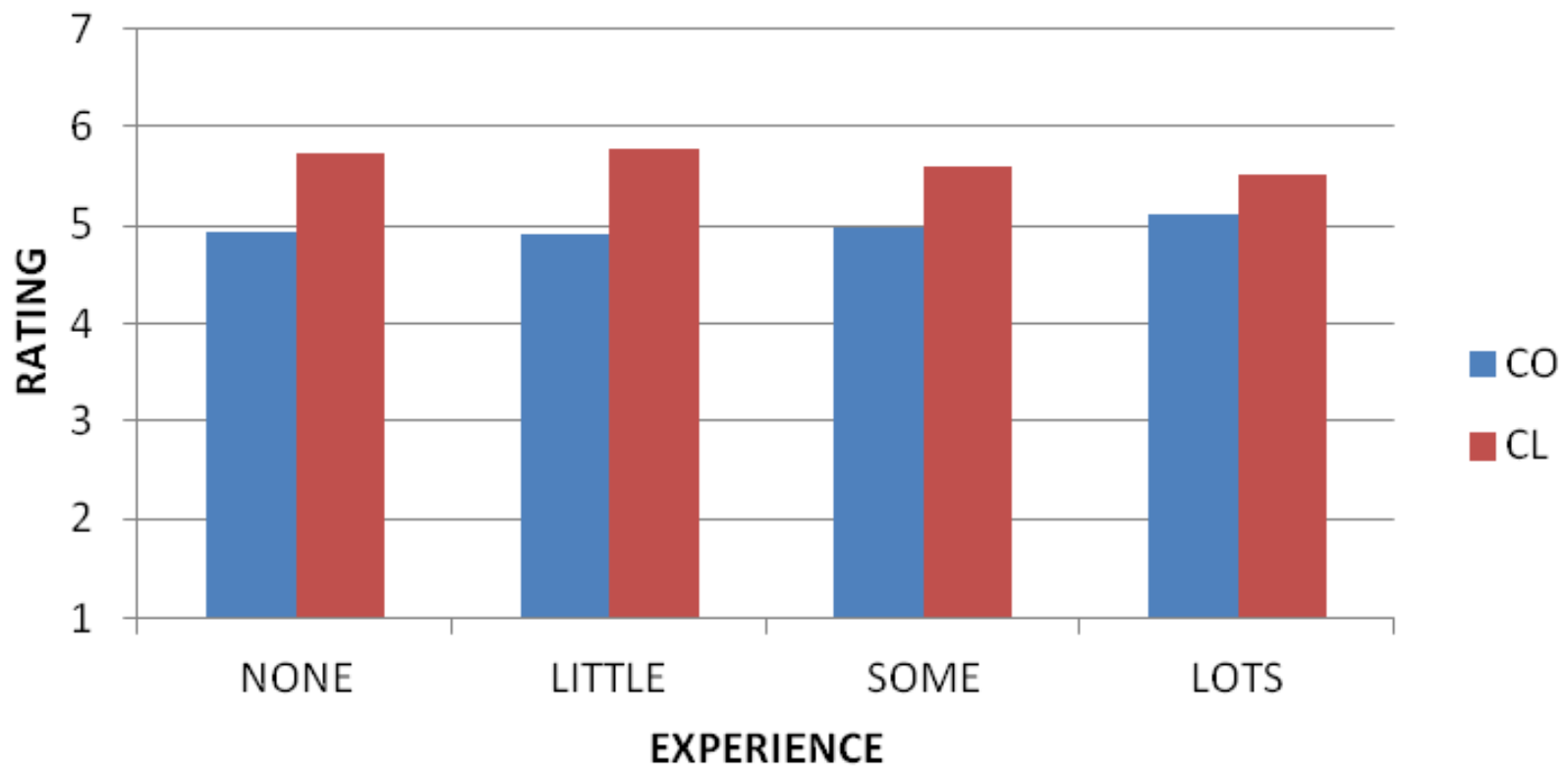


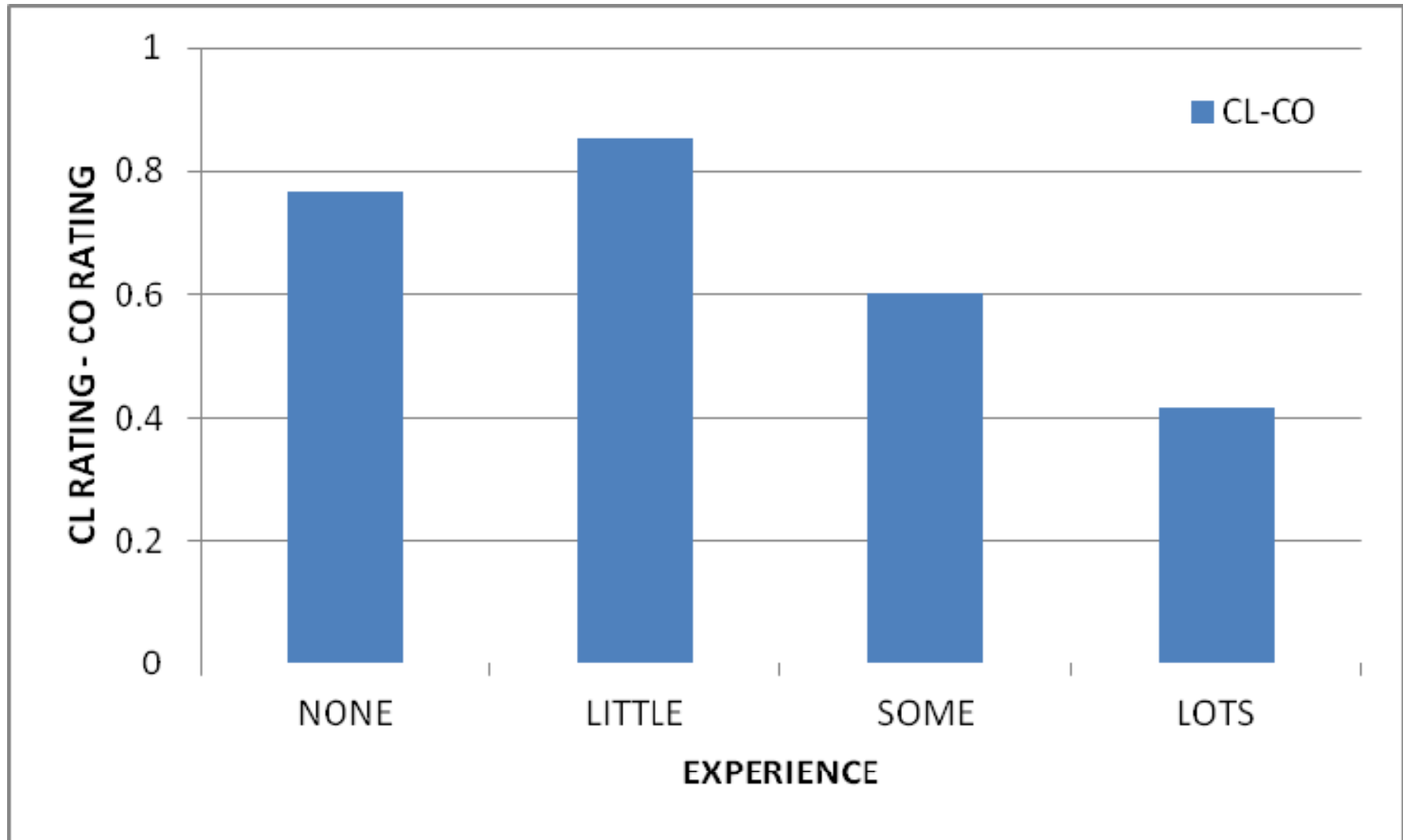
Results

- Main effects of **age bracket** and **experience** communicating with people with hearing loss were **not significant**, and **neither factor interacted** with speaking style or listener group



CO & CL RATING BY EXPERIENCE





Preliminary conclusions

- The **wide talker variability** observed for vowel intelligibility in noise also occurs for **subjective clarity of sentences**
- Talkers who produce **bigger clear speech effects for YNH listeners** also do so for **OHI listeners**
 - Suggests YNH and OHI listeners **benefit from the same things**

Preliminary conclusions

- **Talker characteristics** seem to have **no bearing** on overall clarity or the size of the clear speech effect
 - Talker **gender**
 - Talker **age**
 - **Experience** communicating with people with hearing loss?

Future directions

- Analyze data using **mixed-effects models**
 - Greater **statistical power** than ANOVA
 - Take **all of the variance** in the data (among individual listeners, individual tokens) into account
- Examine **relationships** between current data and **other data**

Thanks!

