

# Is a clear speech benefit obtained for speech produced by older adult talkers for younger and older adult listeners?

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## Introduction

- Our project has produced a corpus (elderLUCID) of spontaneous and read speech by older (OA) and younger adult (YA) talkers while interacting with a conversational partner in good and challenging conditions
- We found that the 'clear speech' strategies used by talkers to maintain effective communication can vary with age and hearing status [1]
- Previous studies using 'instructed' clear speech have shown variations in the perceptual effect of clear speech adaptations in OA speech [2,3]

## Objectives

Using materials from the elderLUCID corpus, we ask:

- Is OA speech as intelligible as YA speech when heard in babble noise?
- Does the clear speech produced by OA talkers have the same perceptual benefit as that of YA talkers?
- Are there a listener-age and hearing-status effects on the intelligibility of OA and YA speech?

## Study 1: Adaptive listening test

## Materials and Methods

### Materials

- BKB sentences produced by 4 YA and 4 OA talkers in two conditions:
  - Read to partner, both hearing without interference (NORM sentences)
  - Read to partner who has a simulated hearing-loss [4] (CLEAR sentences)
- Masker: 8-talker babble noise

### Test procedure

- Adaptive procedure tracking SNR corresponding to 67% intelligibility
- 4 sentence blocks (YA-NORM, YA-CLEAR, OA-NORM, OA-CLEAR)

### Participants

- 24 YA, 28 OA with normal hearing (OANH, PTA 4FA  $M=14.1$  dB), 19 OA with mild age-related hearing loss (OAHL, PTA 4FA  $M=25.7$  dB)

## Results

- Talker effect ( $p<.001$ ):** YA voices more intelligible than OA voices
- Listener effect ( $p<.001$ ):** YA listeners (-8.1 dB) could tolerate more severe SNRs than both OANH (-6.3 dB) and OAHL (-3.2 dB) listeners; OANH vs OAHL:  $p<.001$ .
- Talker group \* Speaking style ( $p<.001$ ):** for all listener groups, CLEAR > NORM intelligibility for YA talkers ( $p<.001$ ) but not for OA talkers ( $p=.980$ ).

## References

[1] Tuomainen, O. & Hazan, V. (2016) Suprasegmental characteristics of spontaneous speech produced in good and challenging communicative conditions by younger and older adults, *Journal of the Acoustical Society of America*, 140, 3444 [2] Smiljanic, R., Gilbert, R.C. (2017) Intelligibility of noise-adapted and clear speech in child, young adult, and older adult talker, *Journal of Speech, Language, and Hearing Research*, online first [3] Schum, D.J. (1996) Intelligibility of clear and conversational speech of young and elderly talkers, *Journal of the American Academy of Audiology*, 7, 212-218 [4] Zurek, P. & Desloge, I.G. (2007) Hearing loss and prosthesis simulation in audiology, *Hearing Journal*, 60, 32-33;36,38.

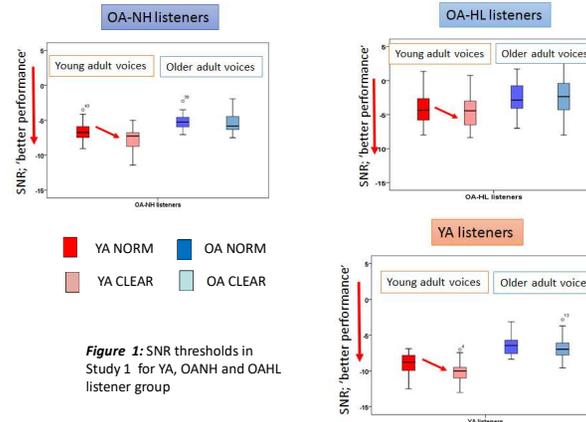


Figure 1: SNR thresholds in Study 1 for YA, OANH and OAHL listener group

- YA voices more intelligible in babble noise than OA voices for both OA and YA listeners
- No clear speech benefit for OA speech. This contrasts with:
  - Findings of acoustic-phonetic adaptations in OA speech
  - Studies showing clear speech benefit for 'instructed' clear speech
- Was the lack of clear speech benefit linked to the use of an adaptive procedure and/or to individual variations in clear speech benefit within the small number of talkers used per group?**

## Study 2: Fixed-procedure listening test

## Materials and Methods

### Materials

- Samples of spontaneous speech (Diapix) for 10 YA, 10 OANH and 10 OAHL talkers (5F) produced in NORM and CLEAR conditions
- Masker: 8-talker babble noise

### Test procedure

- Fixed procedure with levels targeting equal intelligibility levels for YA-NORM speech (YA: -9 dB SNR, OANH: -7 dB SNR, OAHL: -4 dB SNR)
- One block of 120 sentences

### Participants

- 21 YA, 16 OANH, 19 OAHL

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## Results

- Talker group effect ( $p<.001$ ):** YA voices more intelligible than OA voices; OANH and OAHL voices did not differ
- Speaking style effect ( $p<.001$ ):** CLEAR > NORM intelligibility
- Talker group \* Speaking style \* Listener group:** All groups showed intelligibility gains for CLEAR relative to NORM speech but intelligibility levels and clear speech benefit affected by listener groups and their hearing status; Largest NORM-CLEAR improvements for OAHL talkers

	YA-listener	OANH-listener	OAHL-listener	ALL
YA-talker NORM	56.6 (13.9)	59.6 (11.7)	52.2 (20.1)	56.7 (15.5)
YA-talker HLS	68.7 (11.4)	66.5 (13.5)	62.9 (19.4)	66.3 (17.0)
OANH-talker NORM	37.8 (12.6)	44.6 (15.3)	44.4 (19.3)	42.1 (16.9)
OANH-talker HLS	55.3 (12.4)	54.9 (13.2)	61.0 (20.6)	57.1 (15.6)
OAHL-talker NORM	35.8 (14.7)	38.8 (15.5)	41.0 (20.2)	38.1 (15.5)
OAHL-talker HLS	58.8 (11.0)	59.0 (11.4)	54.7 (21.2)	57.2 (20.4)

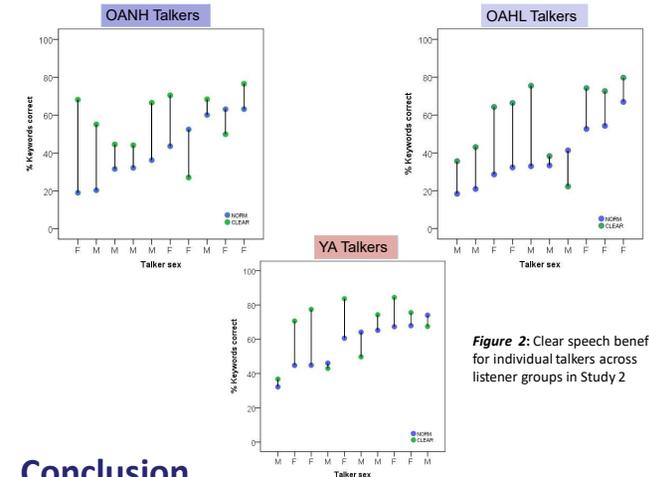


Figure 2: Clear speech benefit for individual talkers across listener groups in Study 2

## Conclusion

- Is OA speech as intelligible as YA speech when heard in babble noise?
  - No
- Does the clear speech produced by OA talkers have the same perceptual benefit as that of YA talkers?
  - Yes? But effect dependent on individual talker characteristics
- Is there a listener-age and hearing-status effect on the intelligibility of OA and YA speech?
  - Yes: higher intelligibility for YA listeners
  - Yes: OANH and OAHL speech did not differ in intelligibility, but greater clear speech benefit obtained for OAHL speech.