

MedCAC

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AMERICAN ACADEMY OF AUDIOLOGY 
How's your hearing? Ask an Audiologist!

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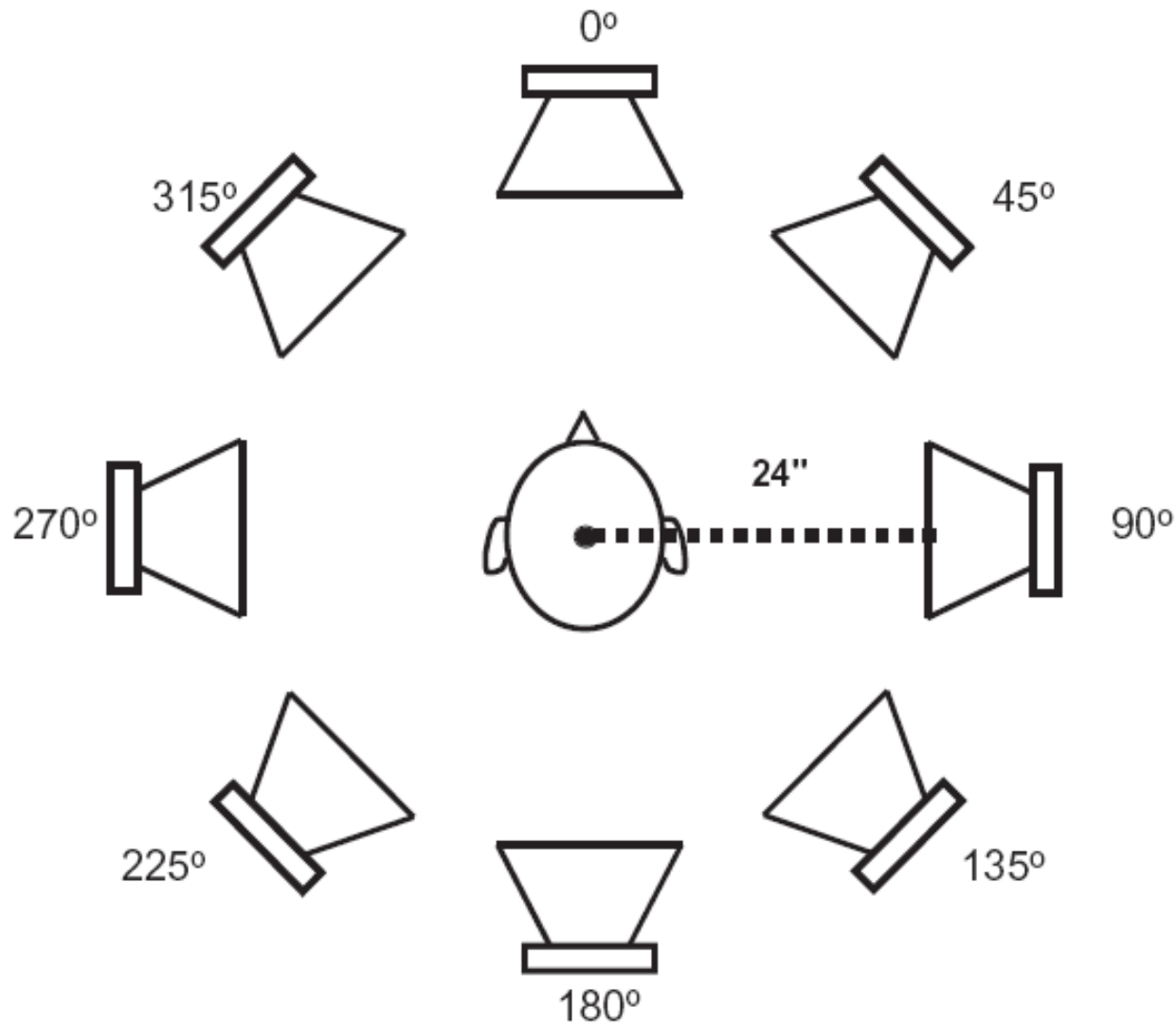


Cochlear Implant Performance in Realistic Listening Environments


- Bimodal & Bilateral
- Various “real-world” listening conditions
- Goal: determine when a bimodal listener should pursue a second CI



Realistic listening environment

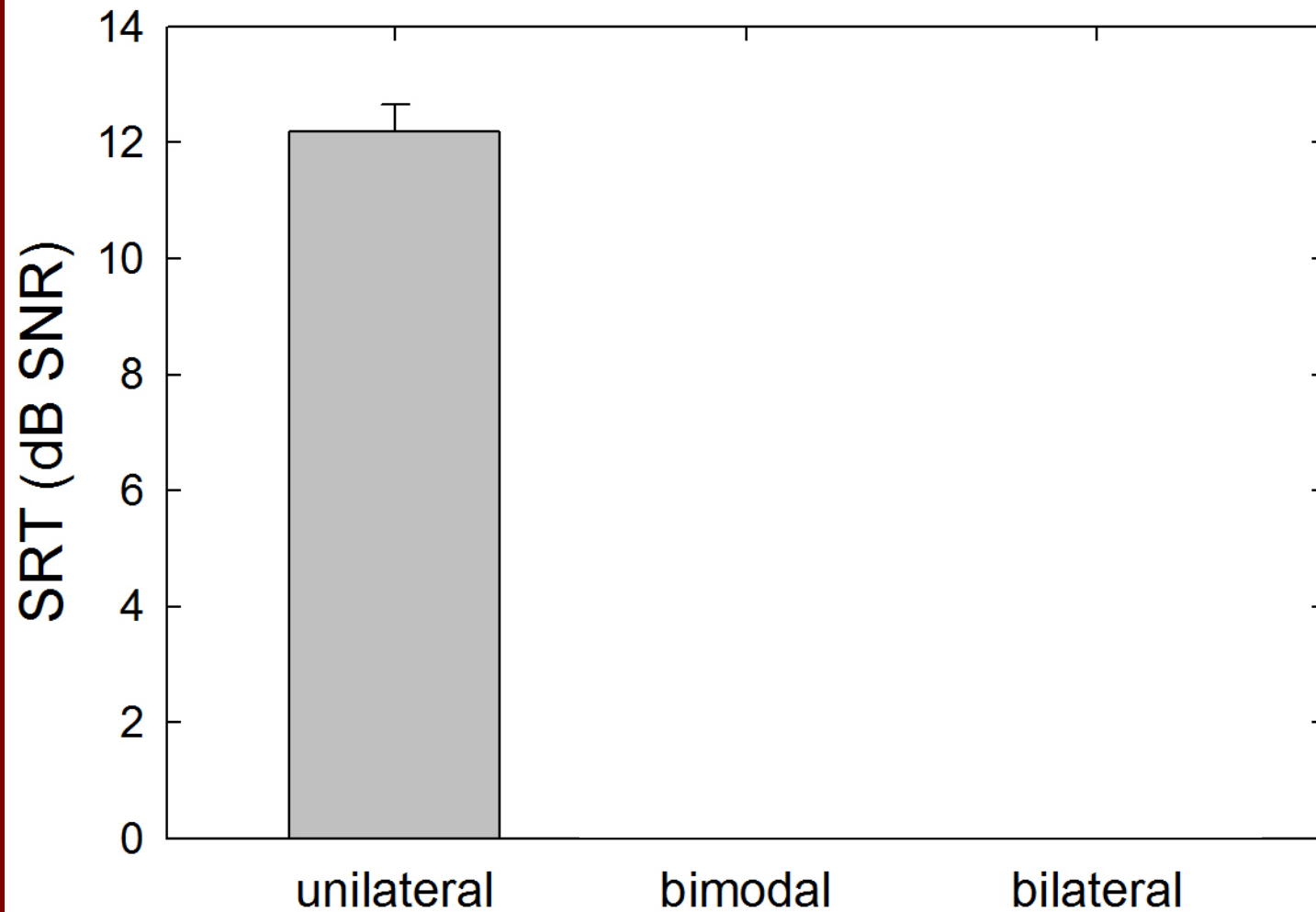


Realistic listening environment

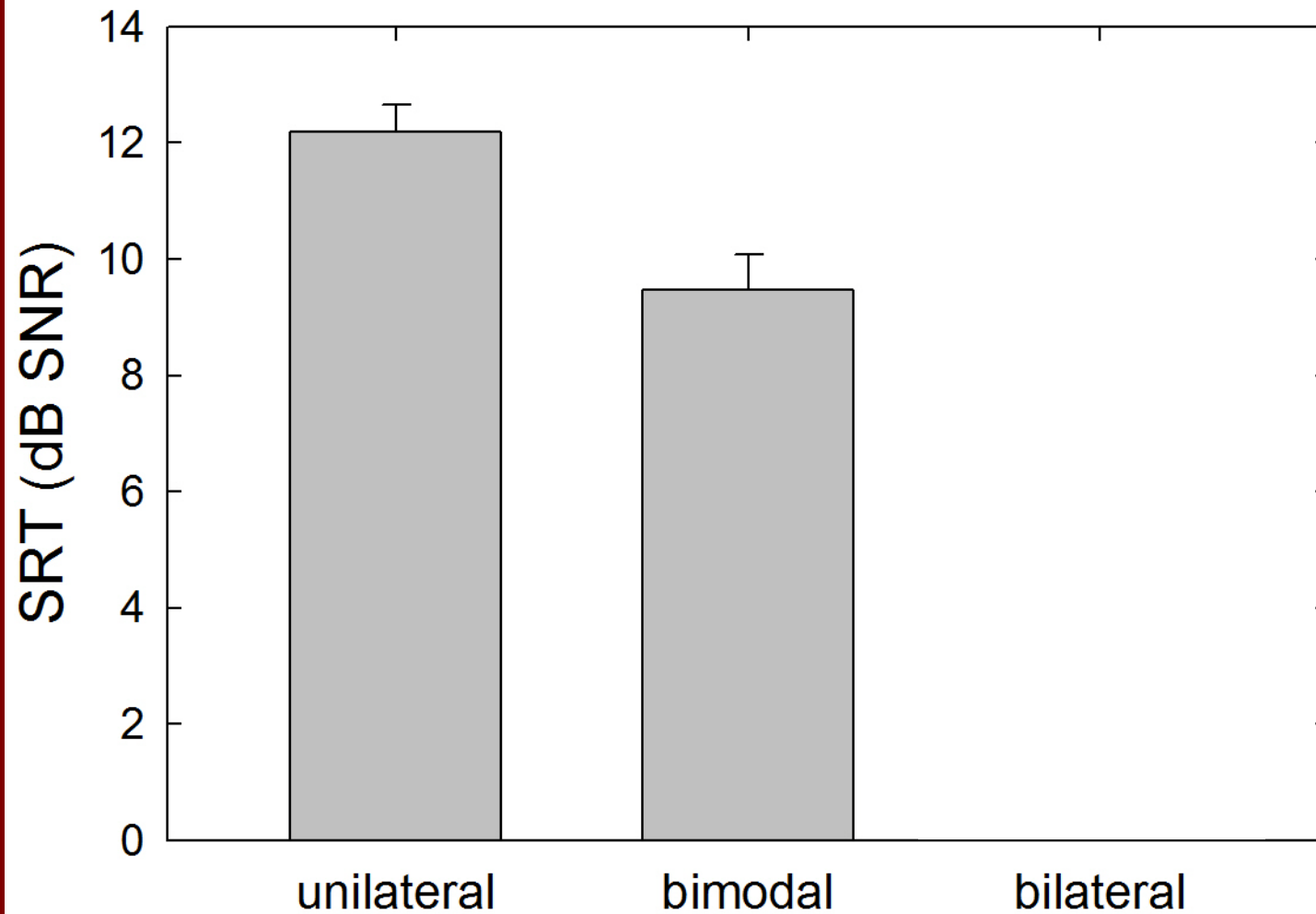
- Restaurant noise recording 
- Noise level fixed at 72 dBA
- Speech varied adaptively to achieve 50% correct
 - Speech reception threshold (SRT)
 - Expressed in dB signal-to-noise ratio (SNR)
- $n = 82$ (mean age: 61.8 yrs)
 - 25 unilateral, 34 bimodal, 25 bilateral



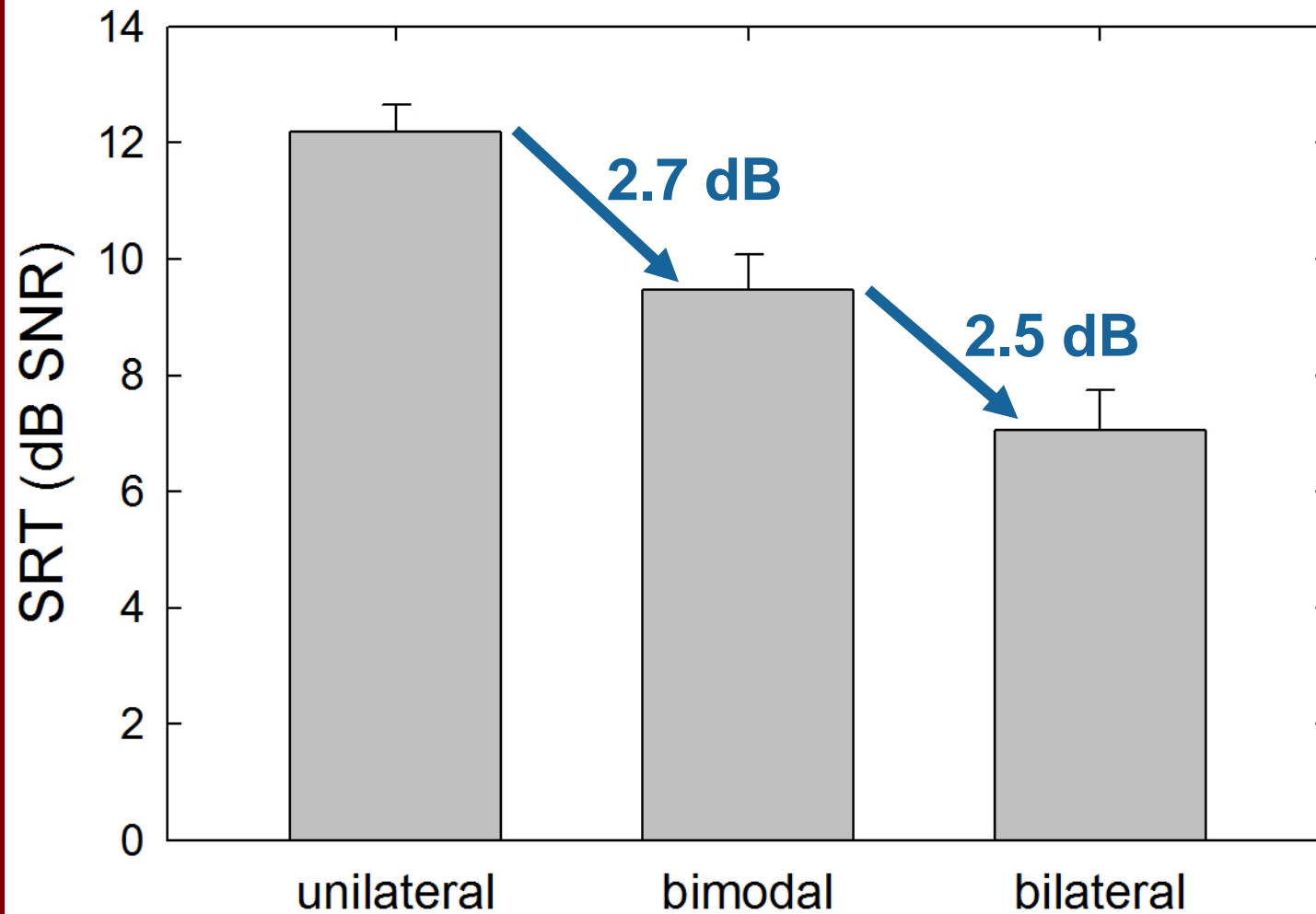
Restaurant simulation



Restaurant simulation



Restaurant simulation



Going from unilateral to bilateral:

- **5.2-dB improvement in the SNR**

Every 1-dB improvement in the SNR \rightarrow 5 to 15 percentage point improvement in performance (Nilsson et al., 1994)

So, 5.2-dB improvement in the SNR \rightarrow Estimated improvement in noise of **26- to 78-percentage points**




For individuals with aidable hearing in the non-implanted ear (bimodal hearing), acquiring a second CI →

- **2.5-dB improvement in the SNR**

2.5-dB improvement in the SNR → improvement in noise of **12.5- to 37.5-percentage points**

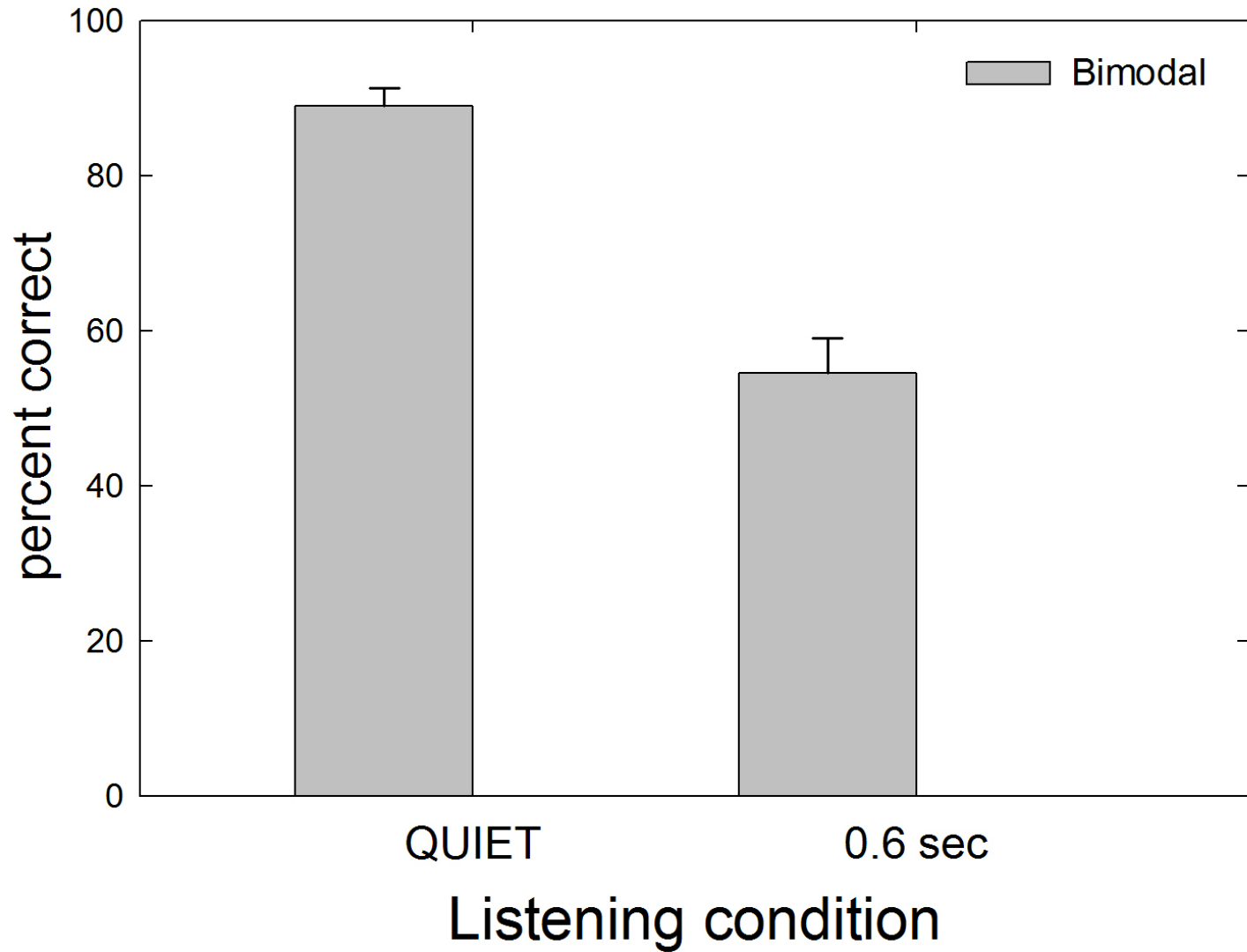


Realistic listening environment

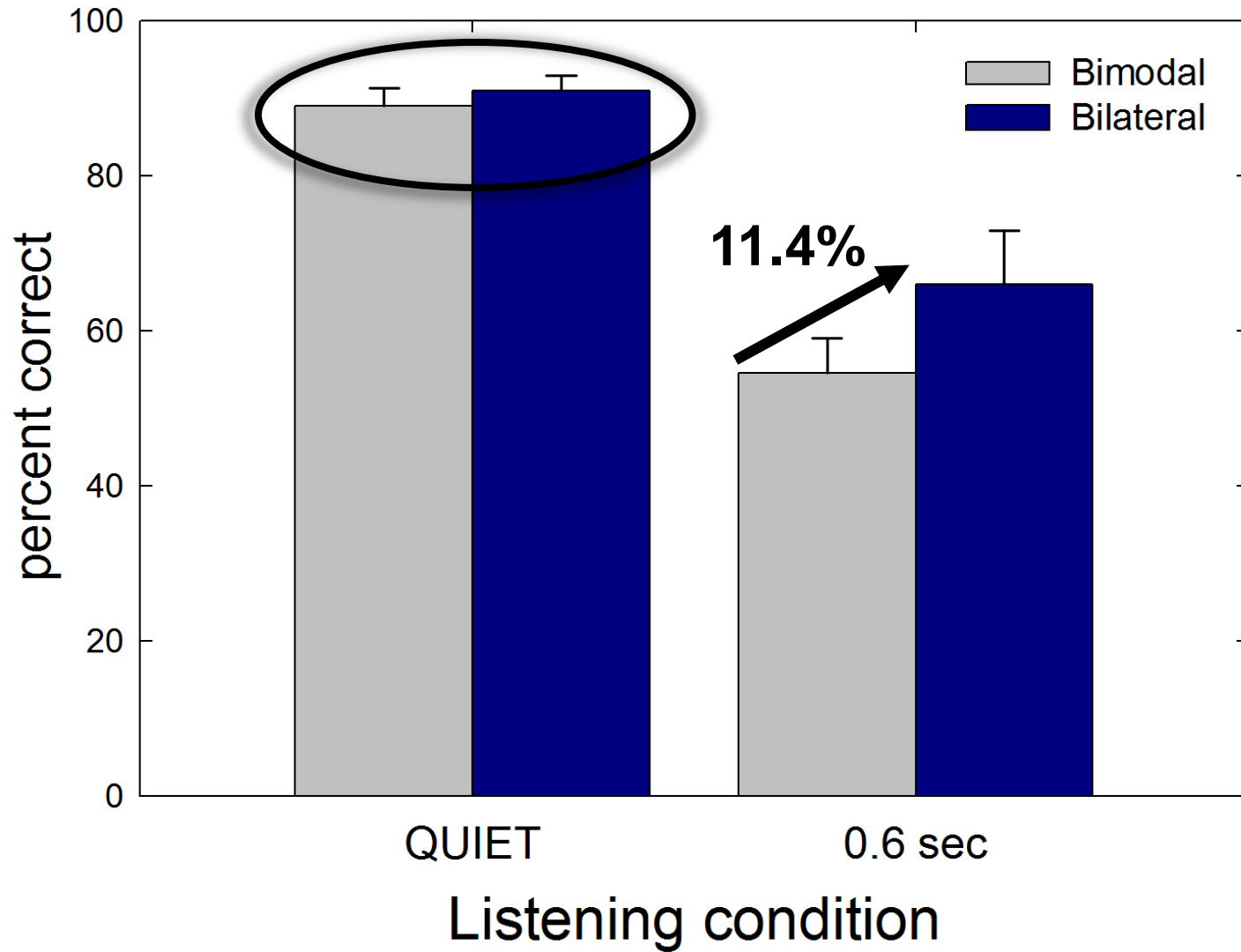
- Reverberant speech 
- Two reverberation times: 0.6 and 1.3 sec
- AzBio sentence recognition
 - Expressed in percent correct
- $n = 53$ (mean age: 62.4 yrs)
 - 35 bimodal, 18 bilateral



Reverberation



Reverberation

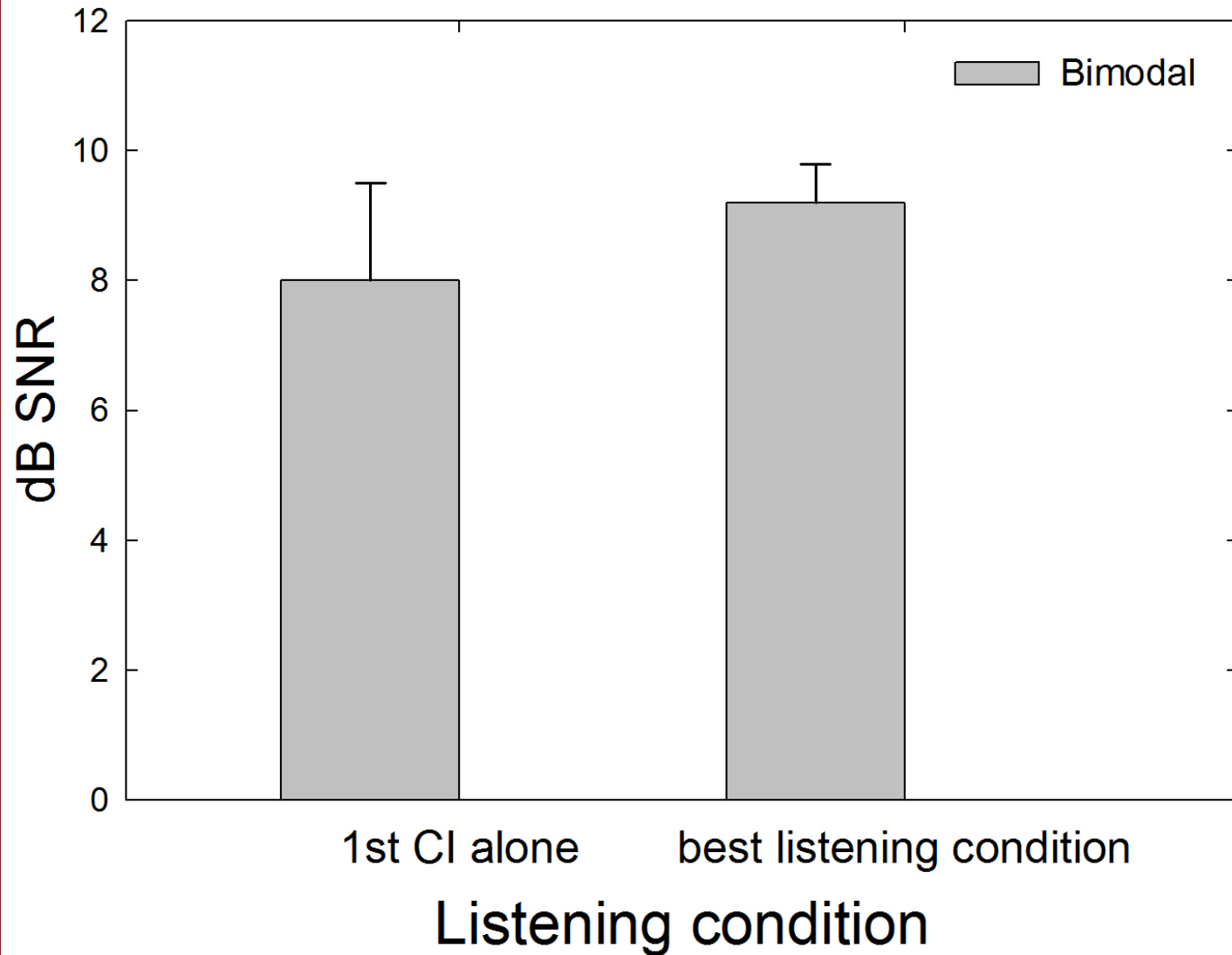


Within subject sample

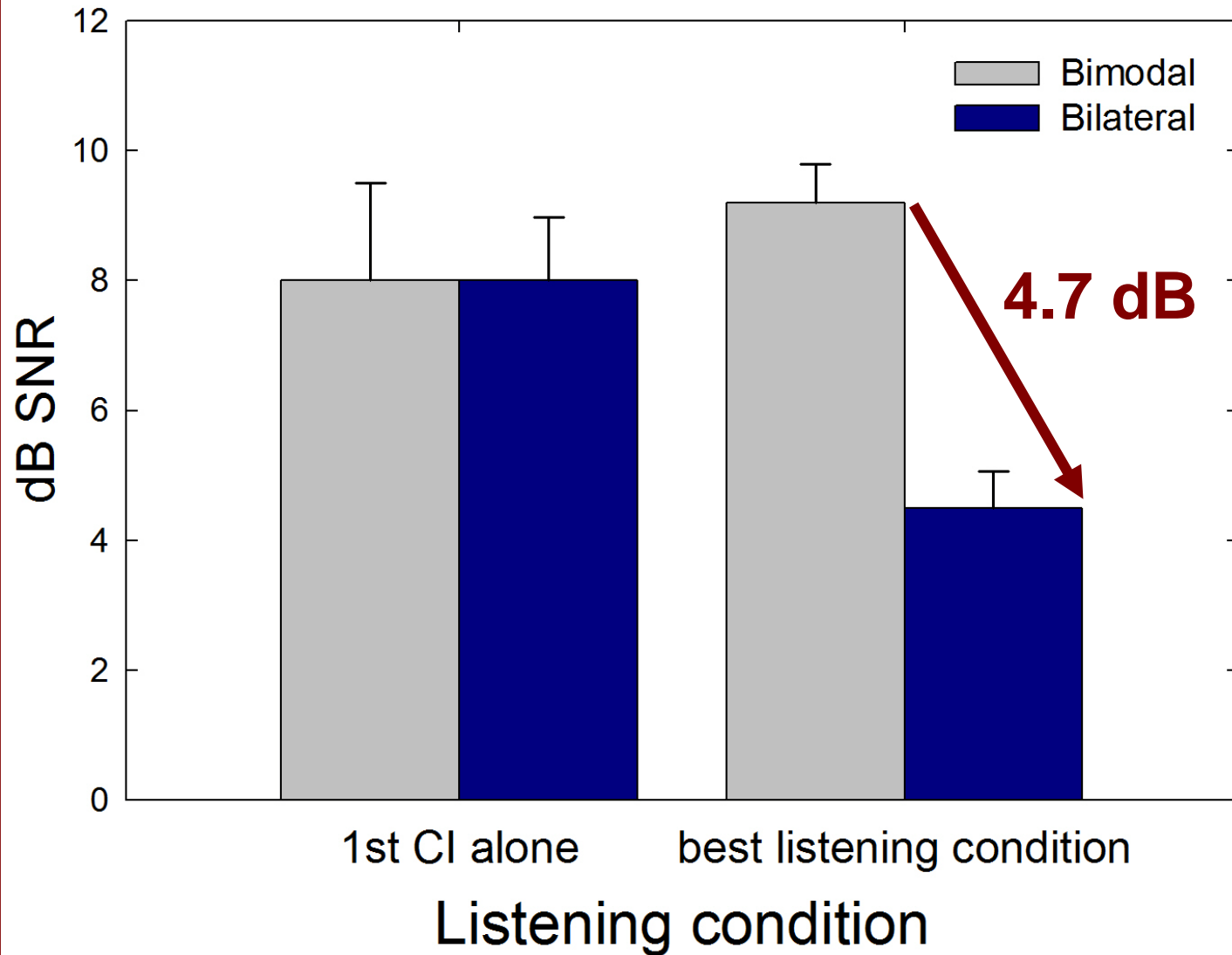
- During first year of project, 5 of the *bimodal* subjects, received a 2nd CI.
- Assessed on same battery of tests:
bimodal and bilateral
- Mean age = 62.3 yrs (range: 50 - 75 yrs)
- Months experience with CI's
 - 1st CI: 40.2 months
 - 2nd CI: 9.5 months



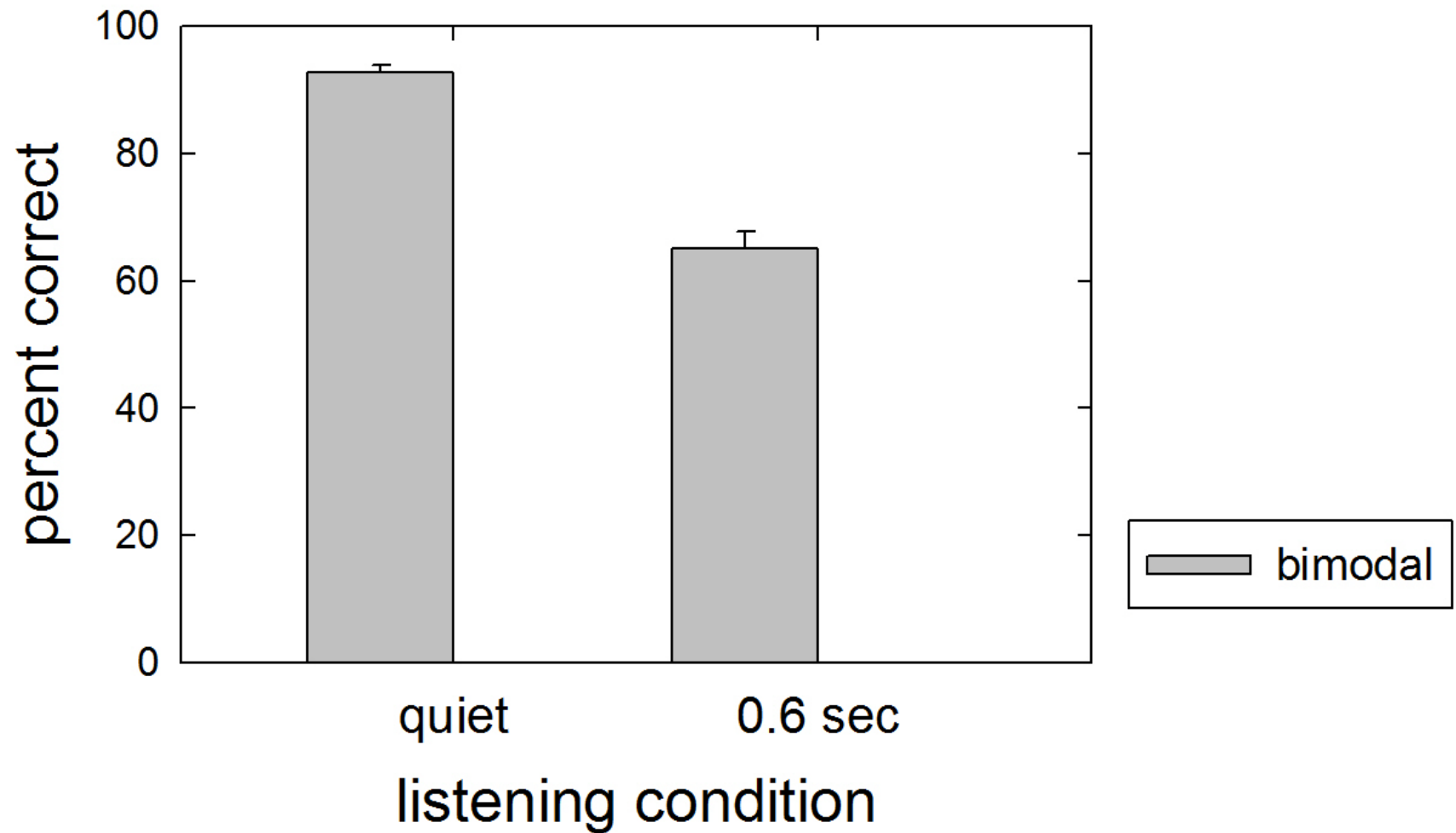
Within subject: restaurant simulation



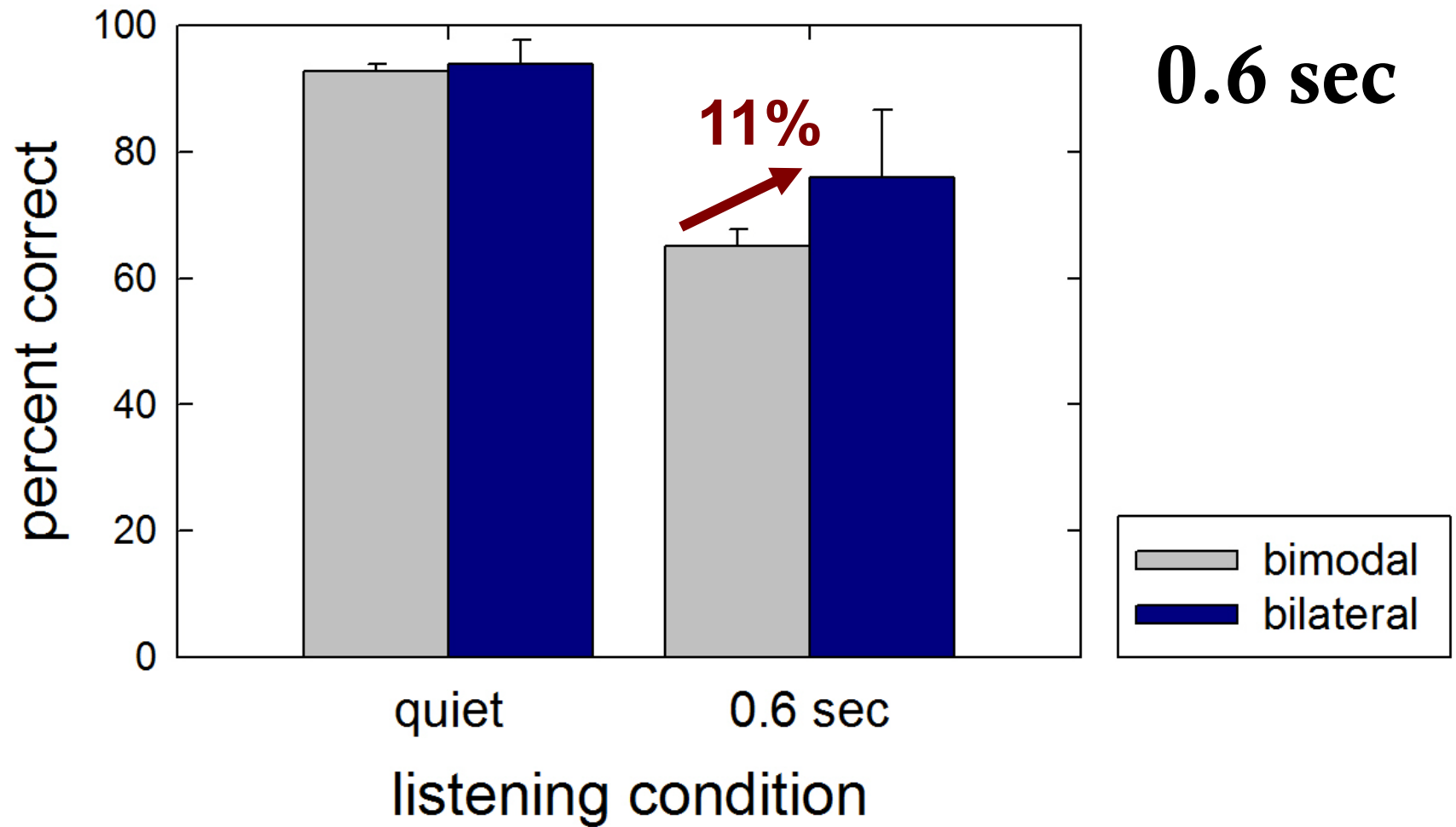
Within subject: restaurant simulation



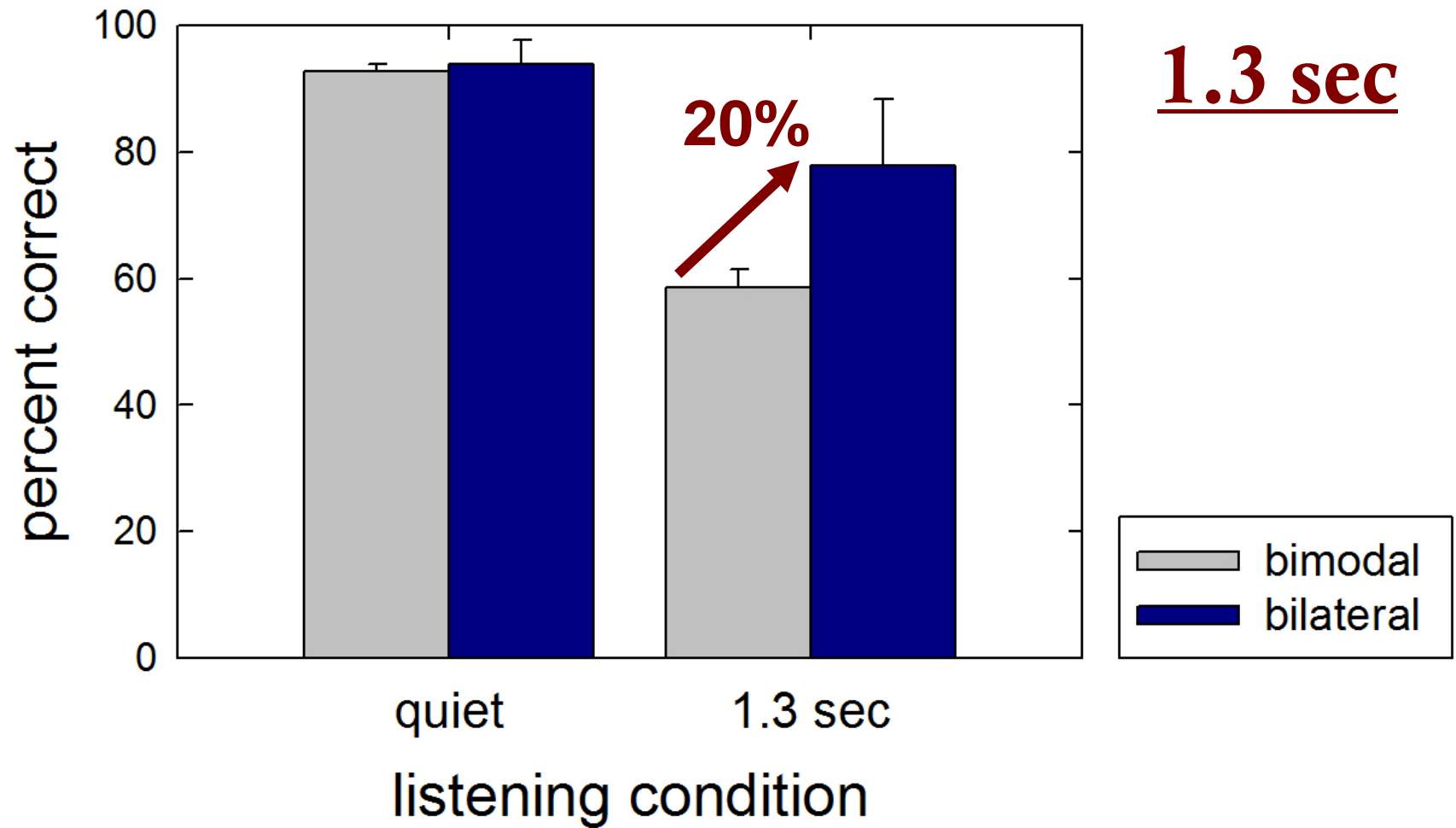
Within subject: reverberation



Within subject: reverberation



Within subject: reverberation



**Do older CI recipients demonstrate less
benefit from cochlear implantation?**

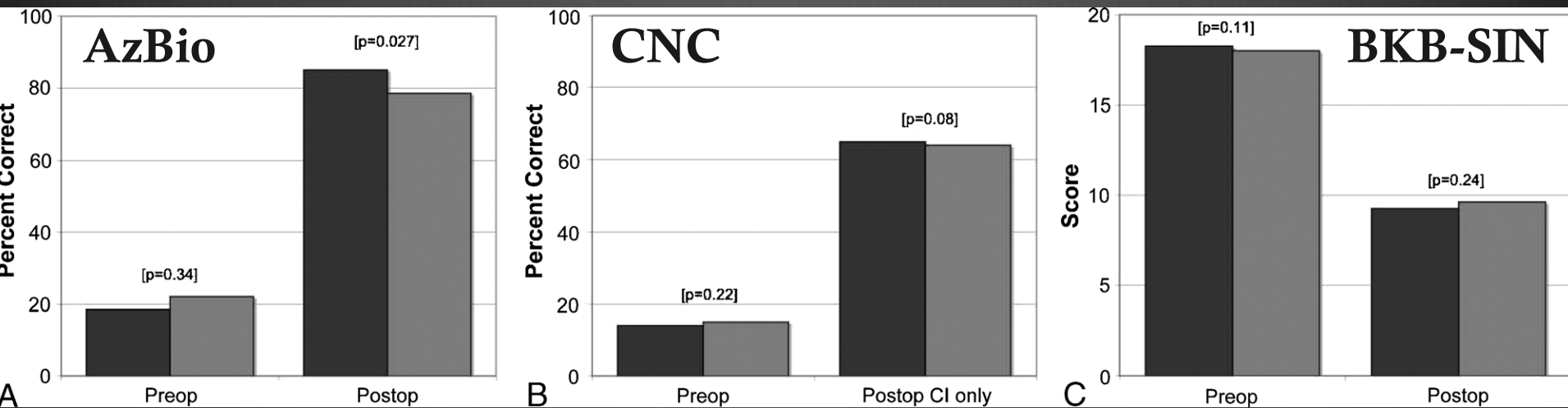


Carlson ML, Breen JT, Gifford RH, Driscoll CL,
Neff BA, Beatty CW, Peterson AM, Olund AP.
(2010). Cochlear implantation in the octogenarian
and nonagenarian. *Otol Neurotol*, 31(8):1343-9.

- $n = 232$ (258 devices)
 - 18 to 79 yrs: $n = 208$
 - 80+ yrs: $n = 50$
- only newest CI technology



Carlson et al. (2010)



No difference in pre- or post-op performance across age groups for:

- Word recognition (CNC)

- Sentence recognition in noise (BKB-SIN)



Carlson et al. (2010)

Anesthetic and surgical complications

Not significant across age groups:

- Postoperative dizziness, Persistent dizziness, New or worsening tinnitus, Taste disturbances, Superficial wound infection Flap necrosis, Chronic wound pain, Facial nerve paresis, Total device failure, Electrode anomalies

Significant across age groups:

- Perioperative anesthetic complications (major: TIA, cardiac arrhythmia; minor: confusion, urinary retention), postoperative disposition



CONCLUSION

Adding a second implant...

- Improved speech recognition in complex listening environments:
 - Diffuse, restaurant noise
 - Reverberant speech
- Degree of improvement:
 - Restaurant: 2.5 to 4.7 dB
 - Reverberation: 11 to 20 percentage points
- **No effect of age on speech perception outcomes for word recognition nor sentence recognition in noise**



Thank you for your attention.

