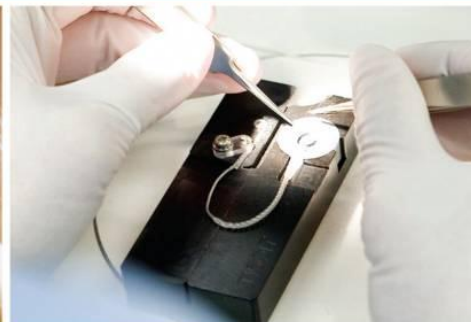
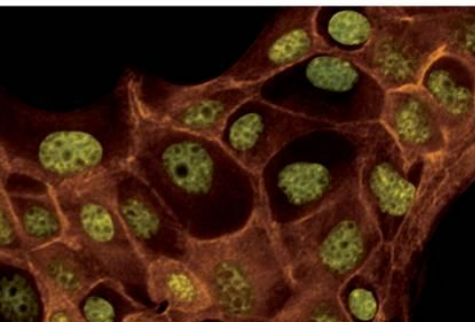


# DEVELOPMENT OF NAL-NL2

Harvey Dillon, Gitte Keidser, Teresa Ching,  
Matt Flax, Scott Brewer

The HEARing CRC & The National Acoustic Laboratories

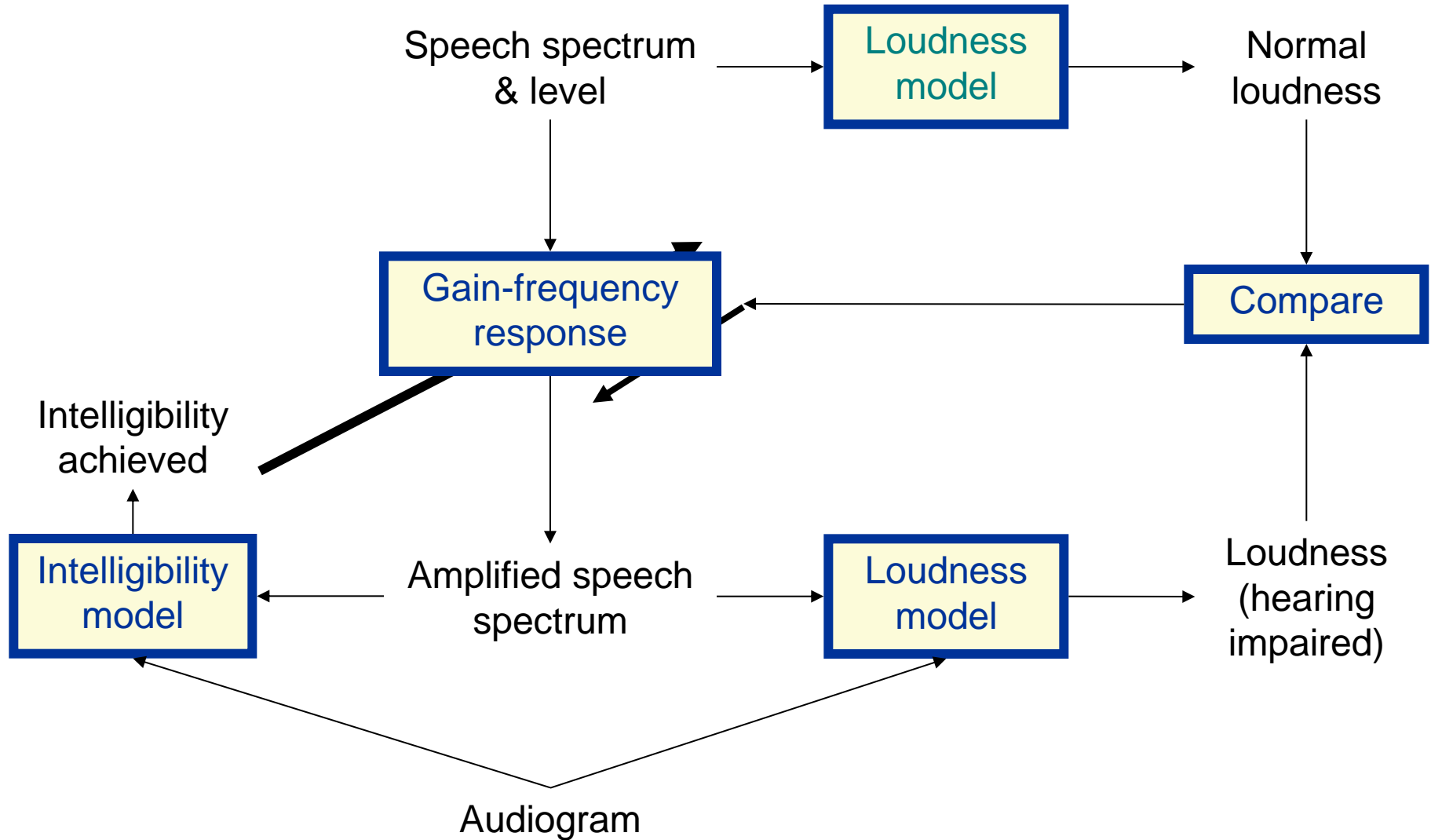
*creating* sound value™



# Prescribe hearing aids to:

- Make speech intelligible
  - Make loudness comfortable
- 
- Prescription affected by other things
    - localization,
    - tonal quality,
    - detection of environmental sounds,
    - naturalness.

# Deriving optimal gains - step 1

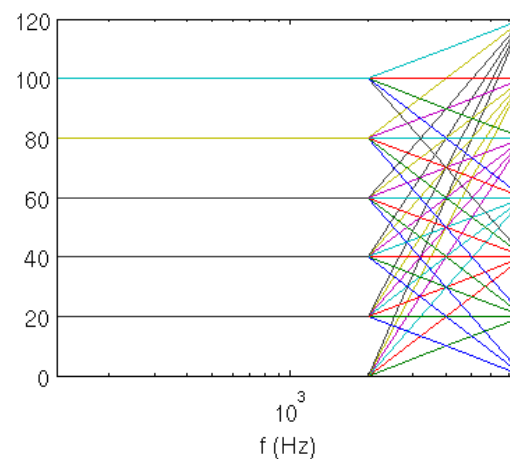
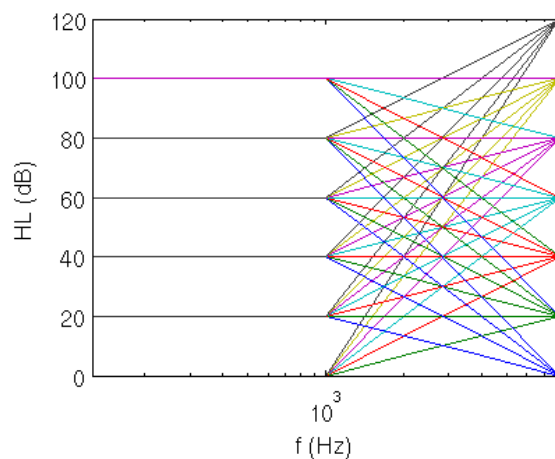
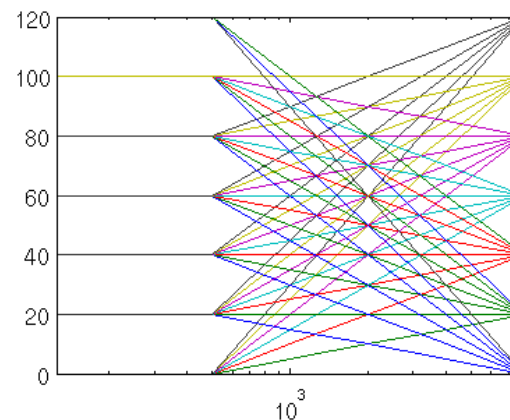
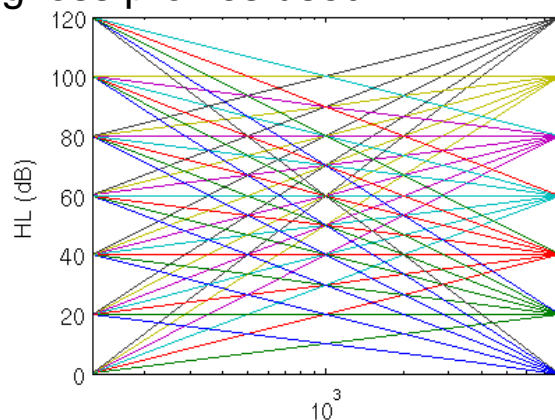


# The audiograms

Rejection criterion :

- $-30 \leq G \leq 60$  , where  $G$  is the slope
- $\text{sum}(H(f))/3 \leq 100$  , where  $f$  is in the set  $\{0.5, 1, 2\}$  kHz

Inverted hearing loss profiles used



# Deriving optimal gains - step 1

Audiogram 1

Speech level 1

Optimal gain frequency response

Audiogram 1

Speech level 2

Optimal gain frequency response

Audiogram 1

Speech level 3

Optimal gain frequency response

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Audiogram 2

-----  
Speech level 1

-----  
Optimal gain frequency response

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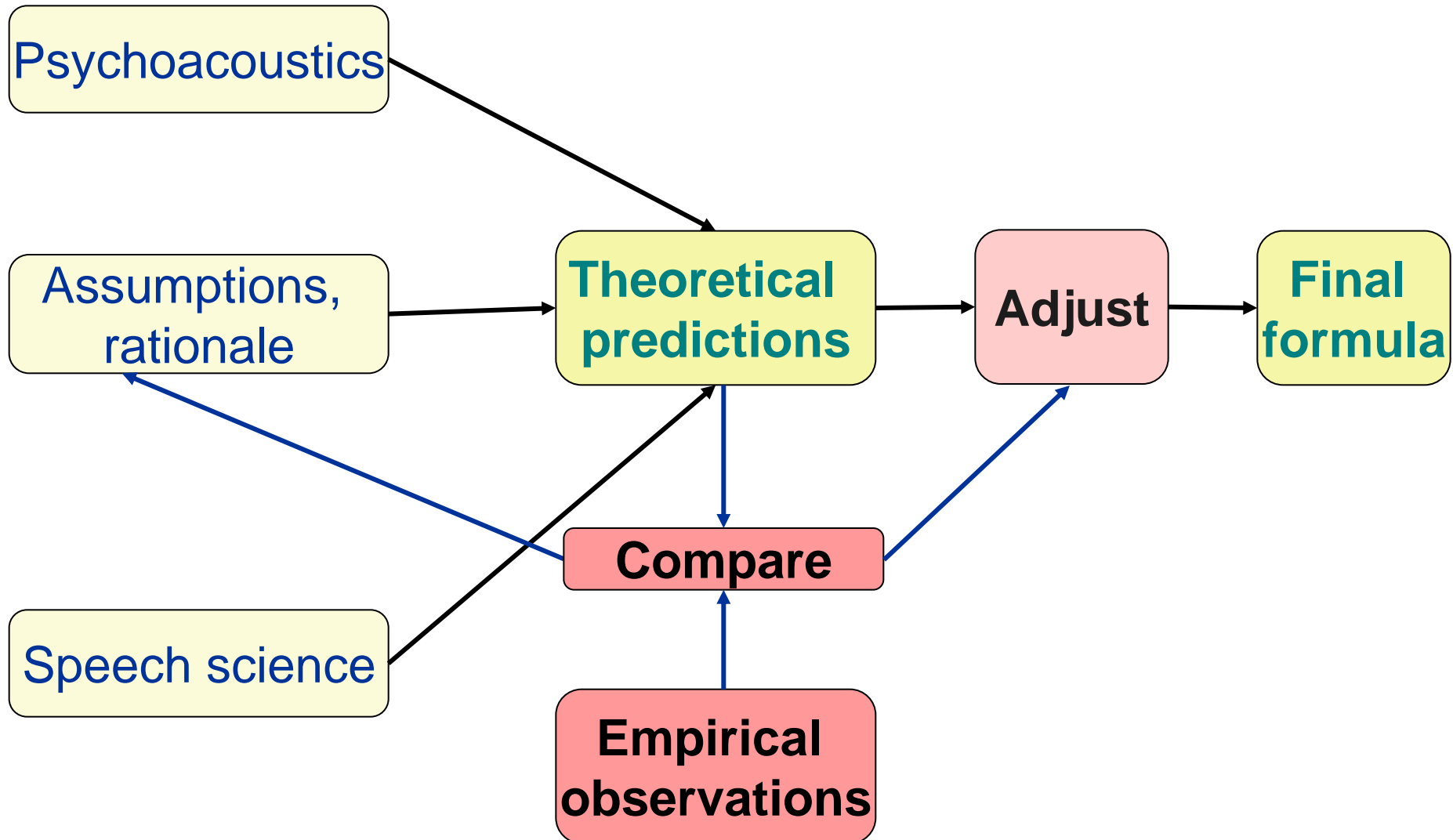
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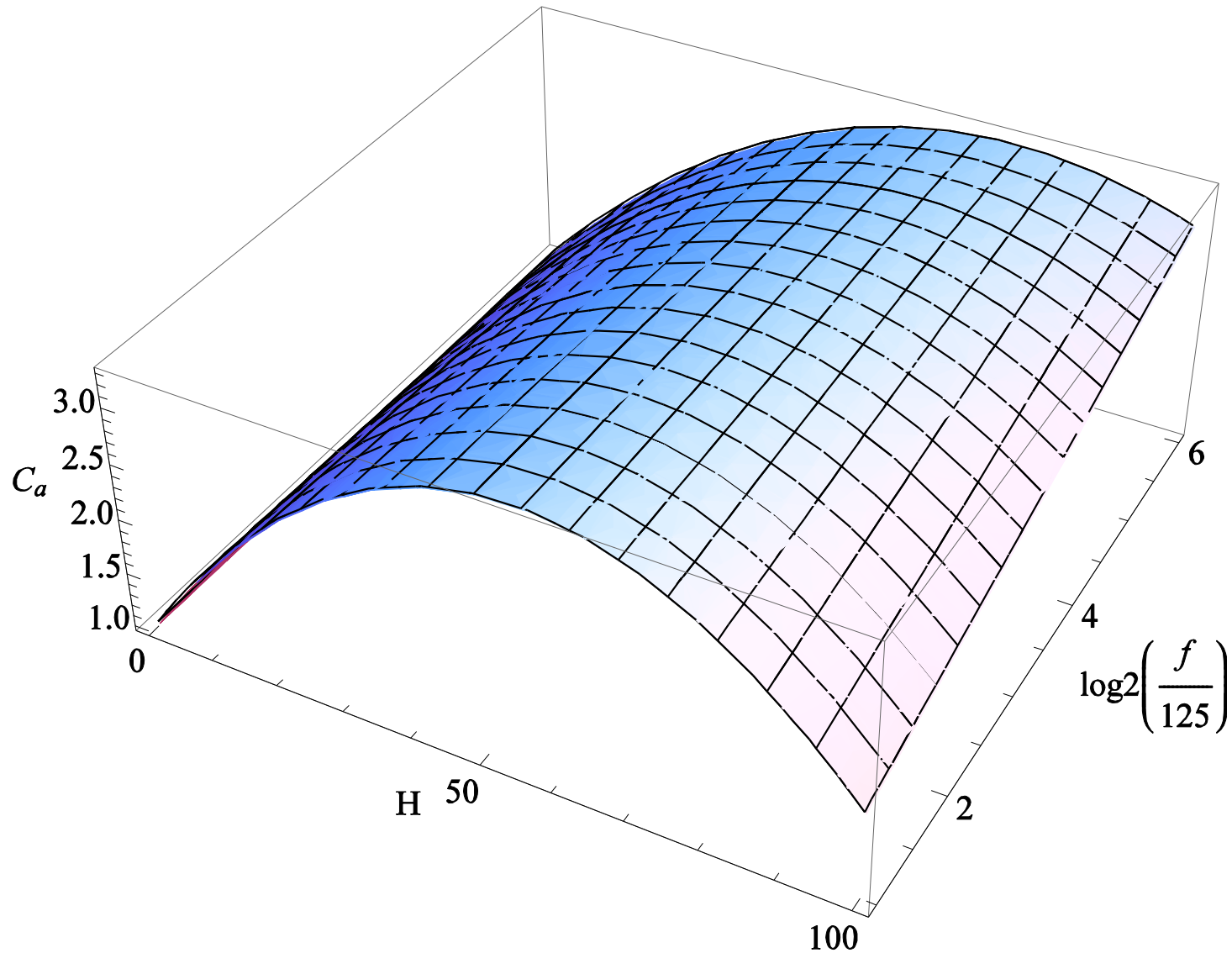
200 audiograms x 6 speech levels → 1200 gain–frequency responses, each at 20 frequencies from 125 Hz to 10 kHz

# Overall prescription approach

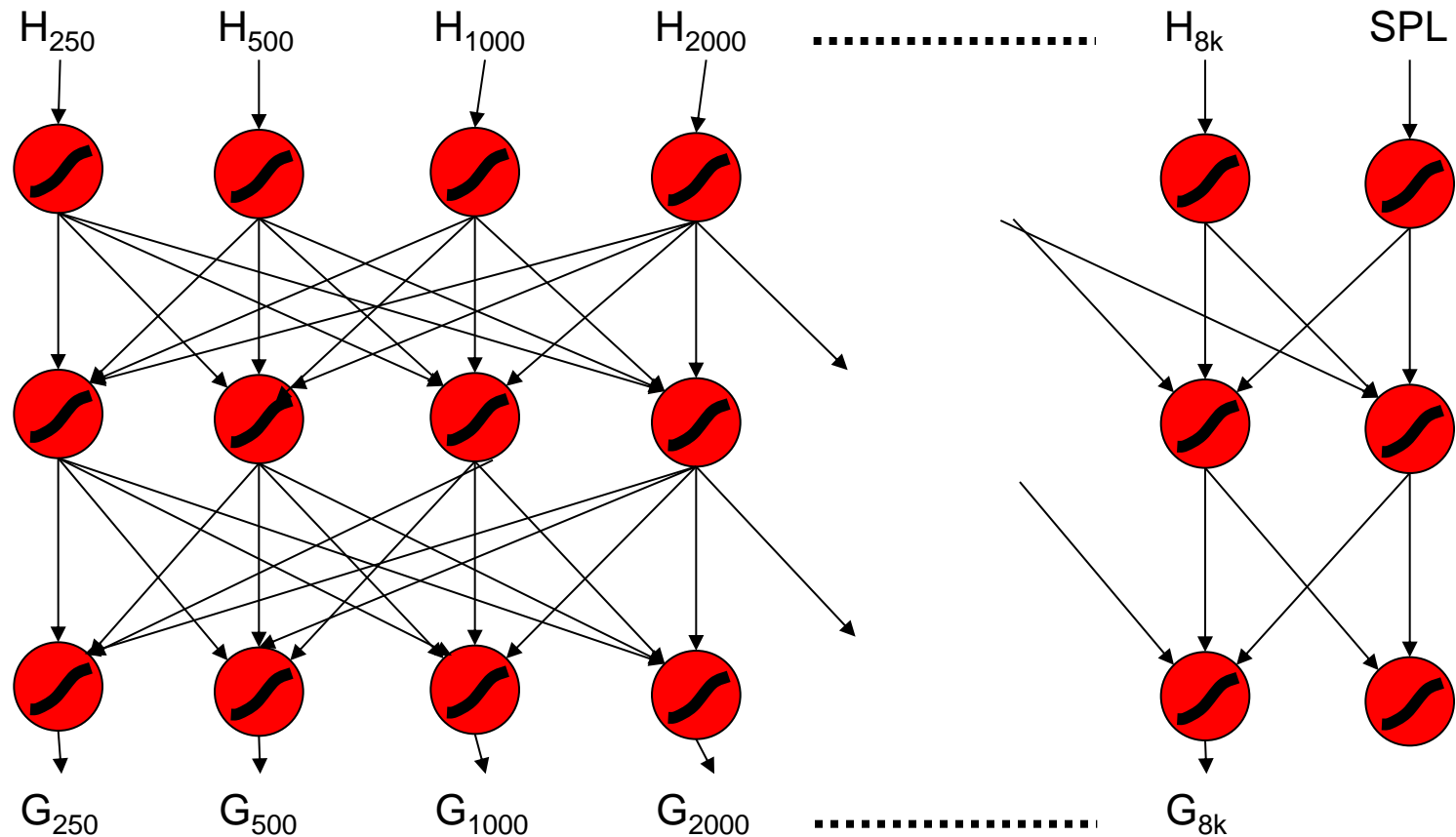


# Limiting compression ratio

The maximum C

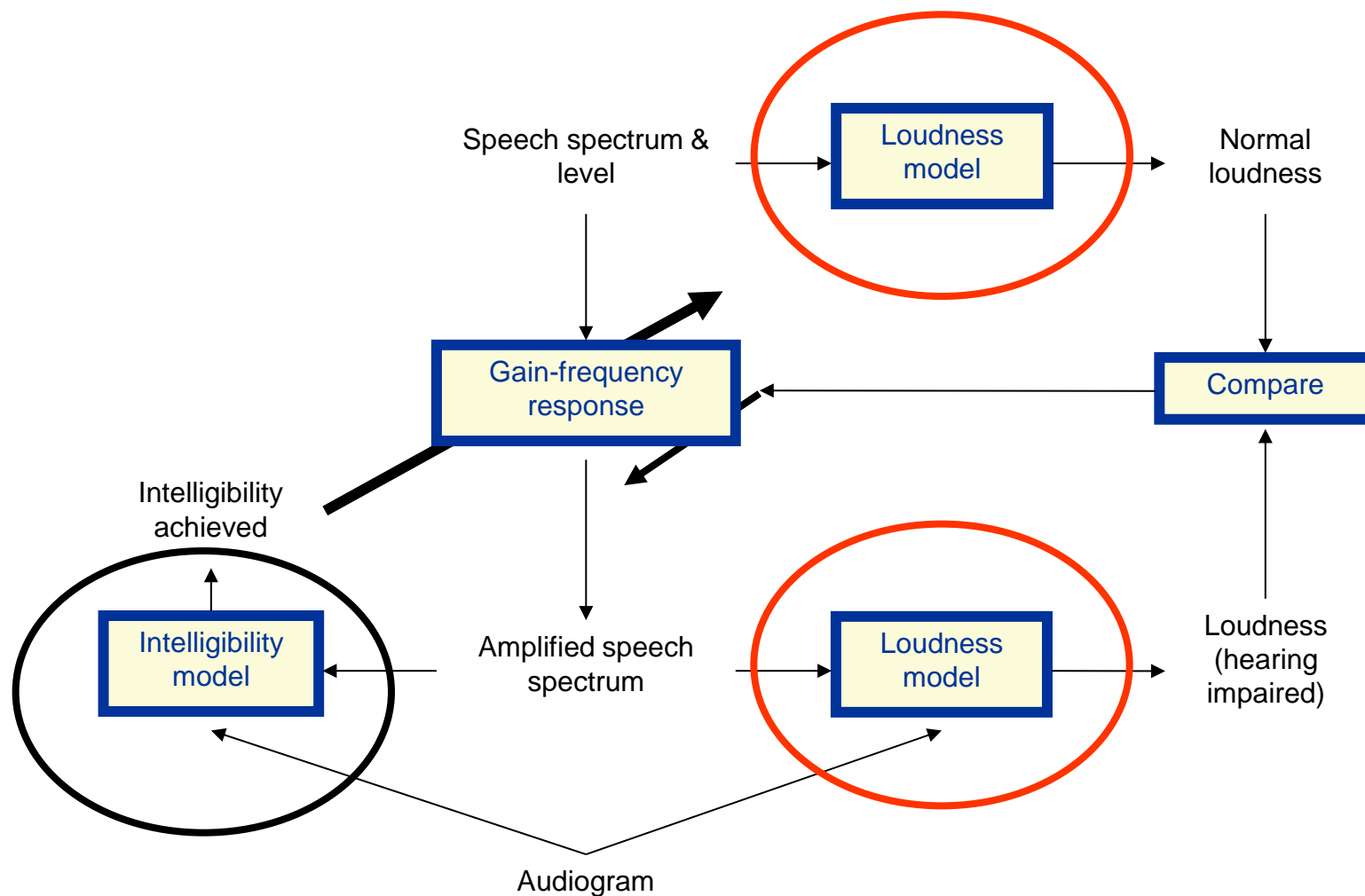


## A neural network





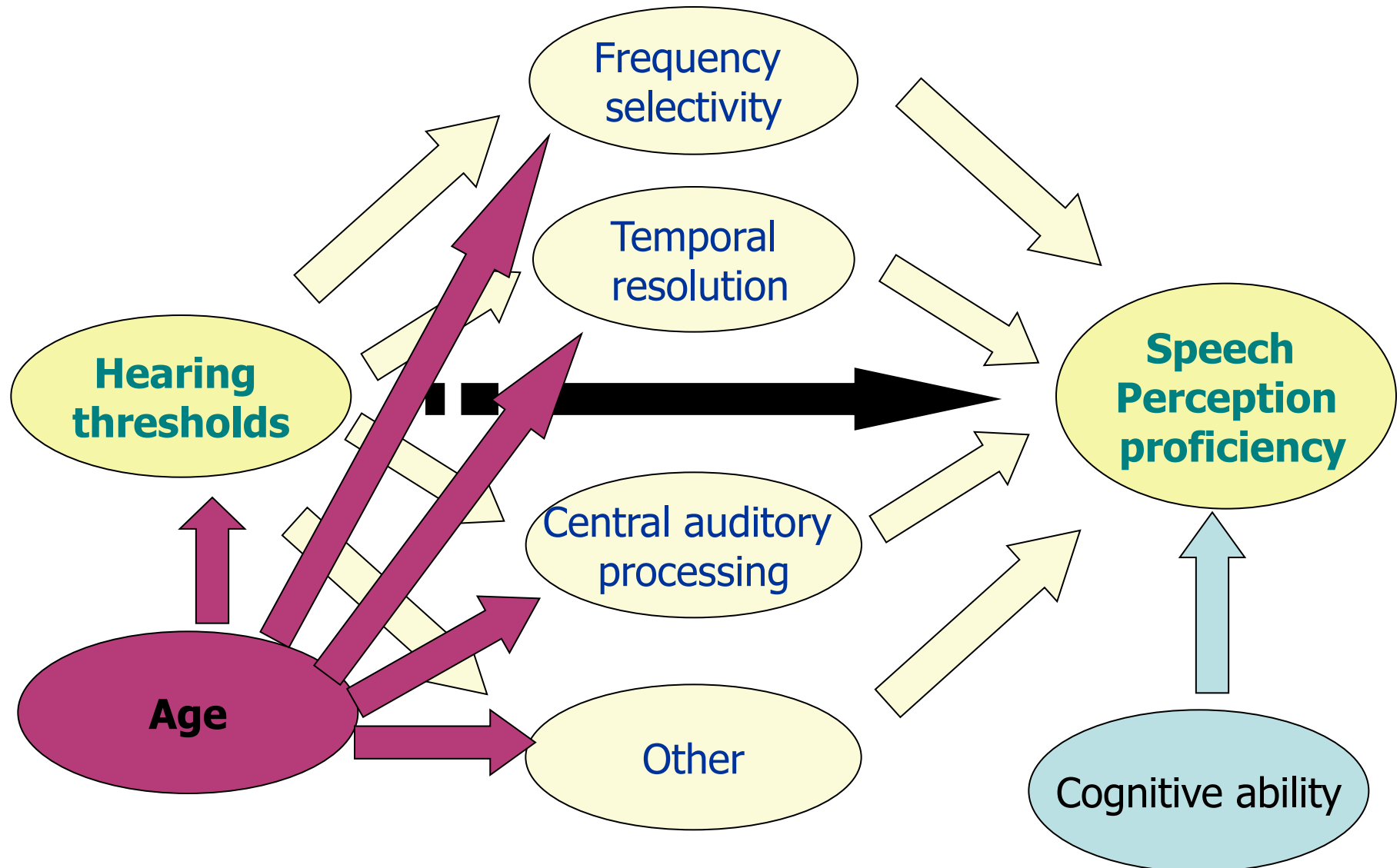
# The two key ingredients



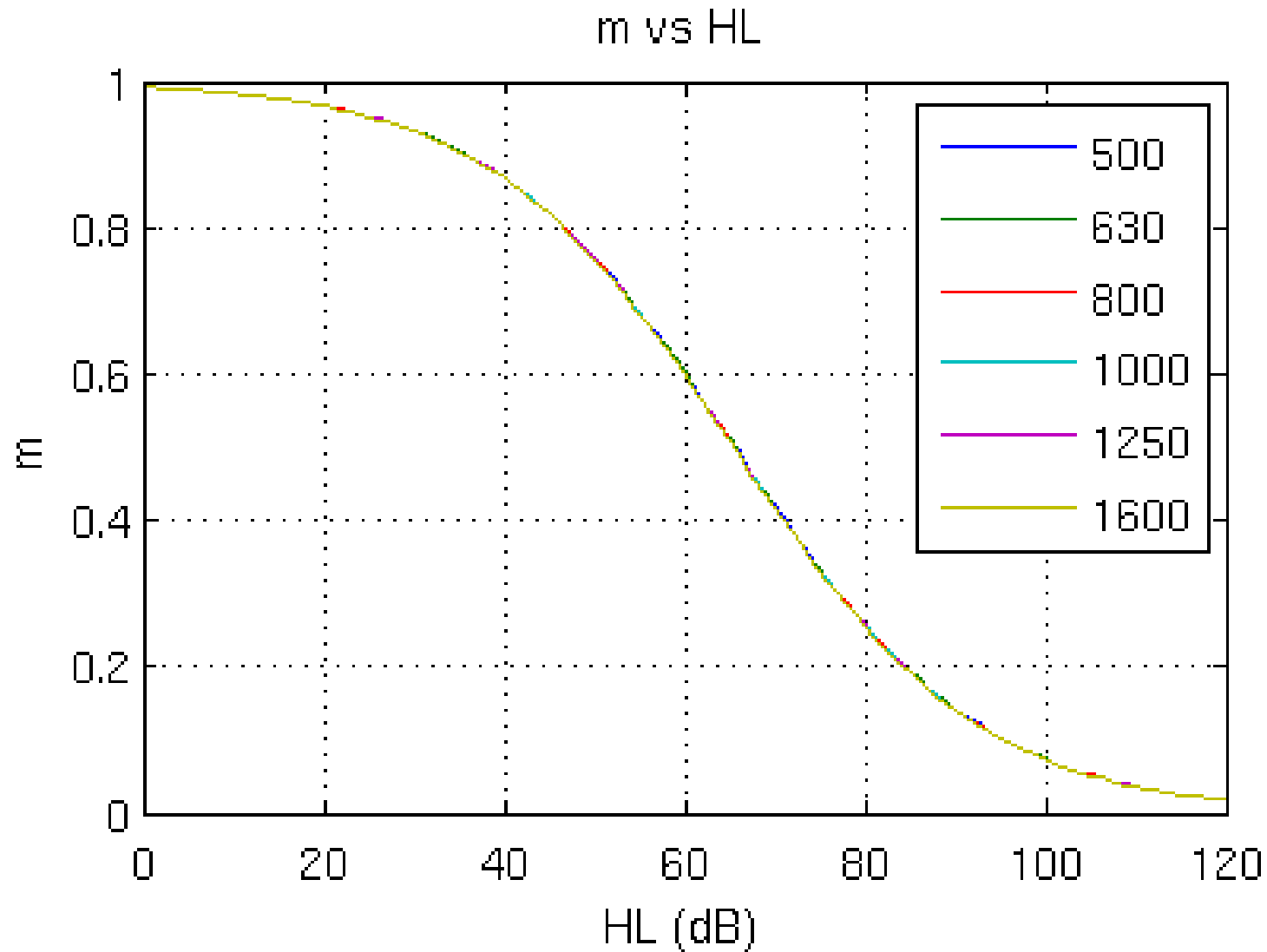
# Psychoacoustics



# Why are hearing thresholds so useful?



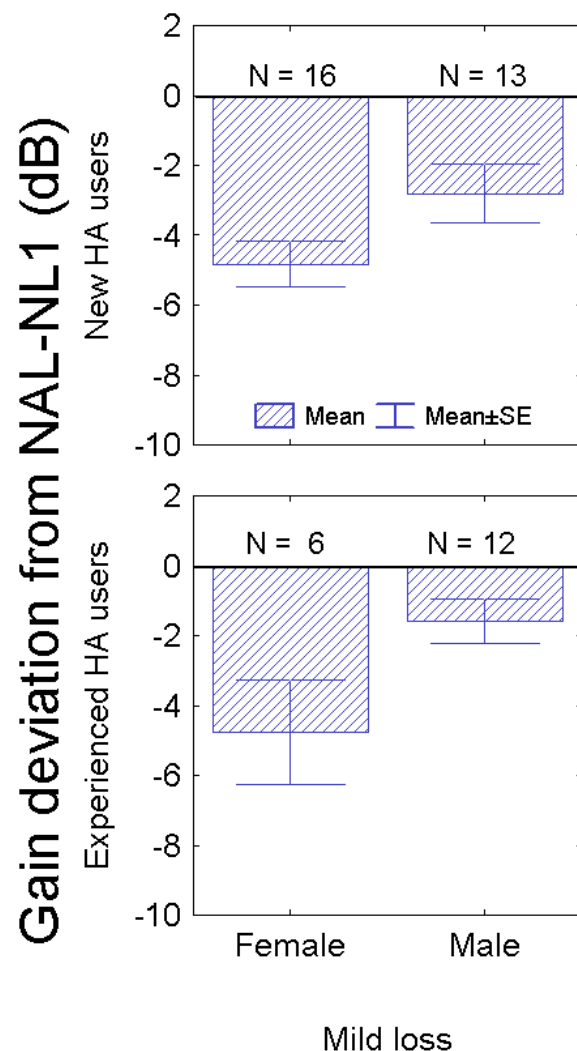
# BKB, VCV and CUNY



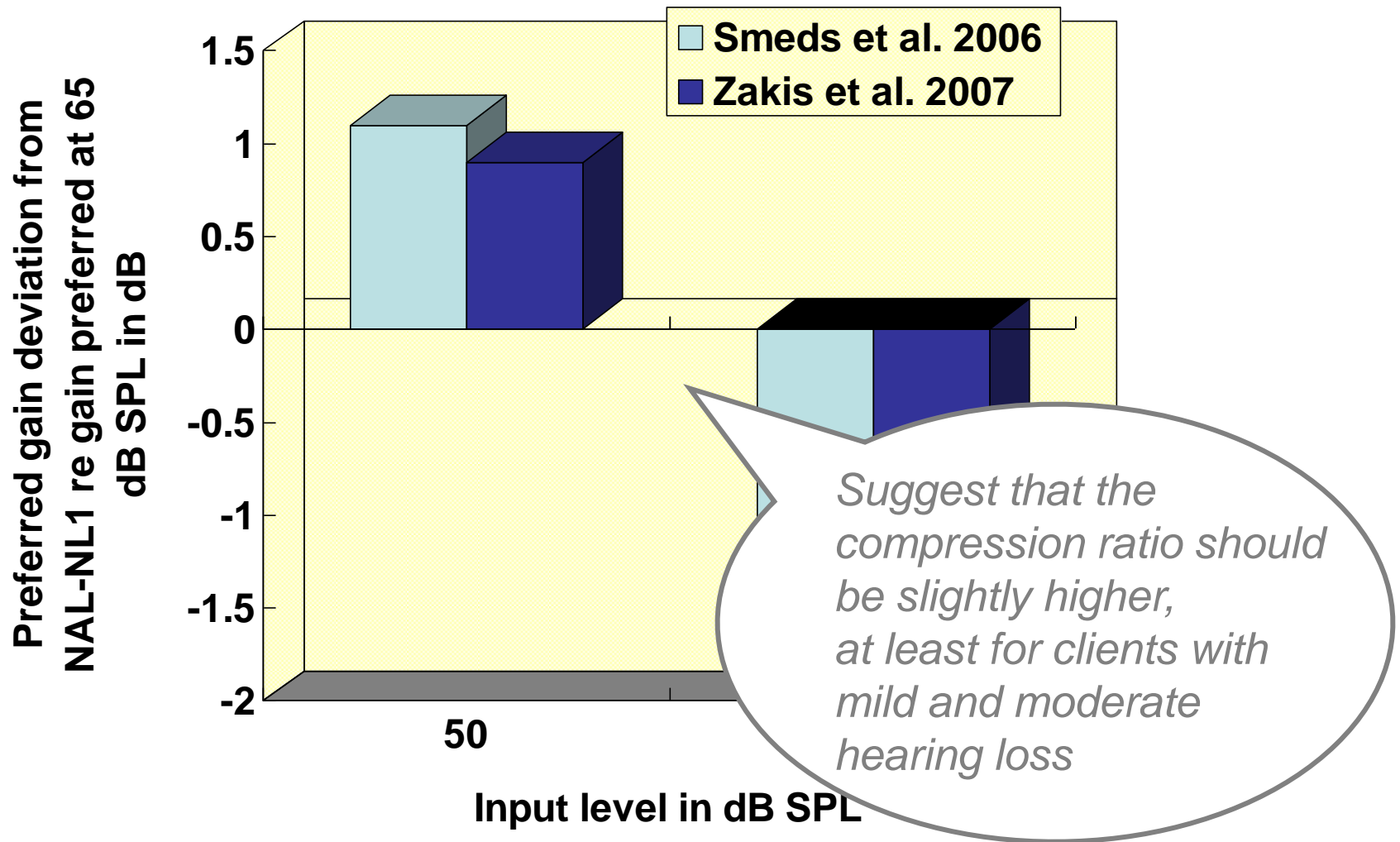
# Factors affecting prescription

# Gain; adults, medium input level

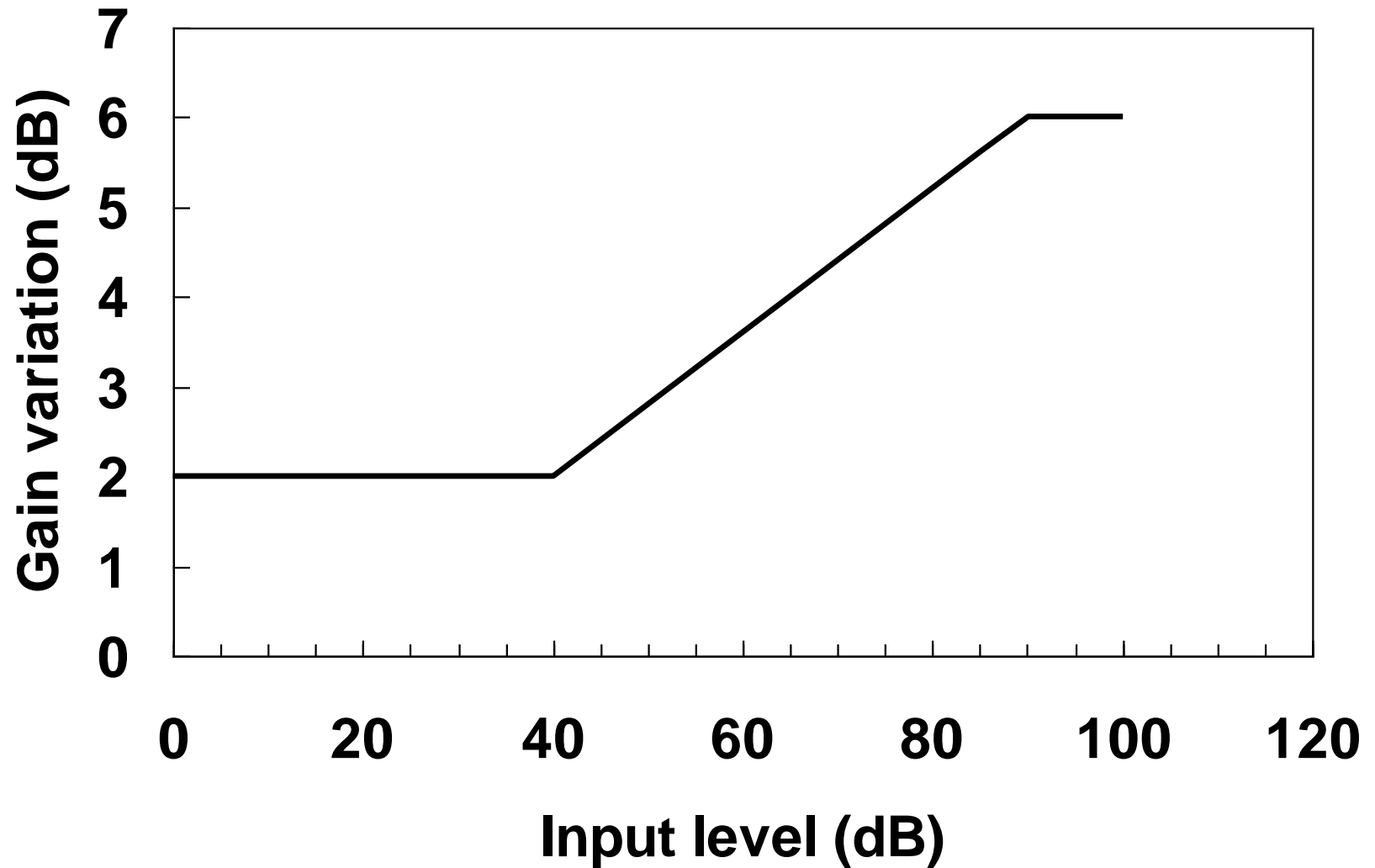
(N = 187)



# Gain for adults: low & high input levels

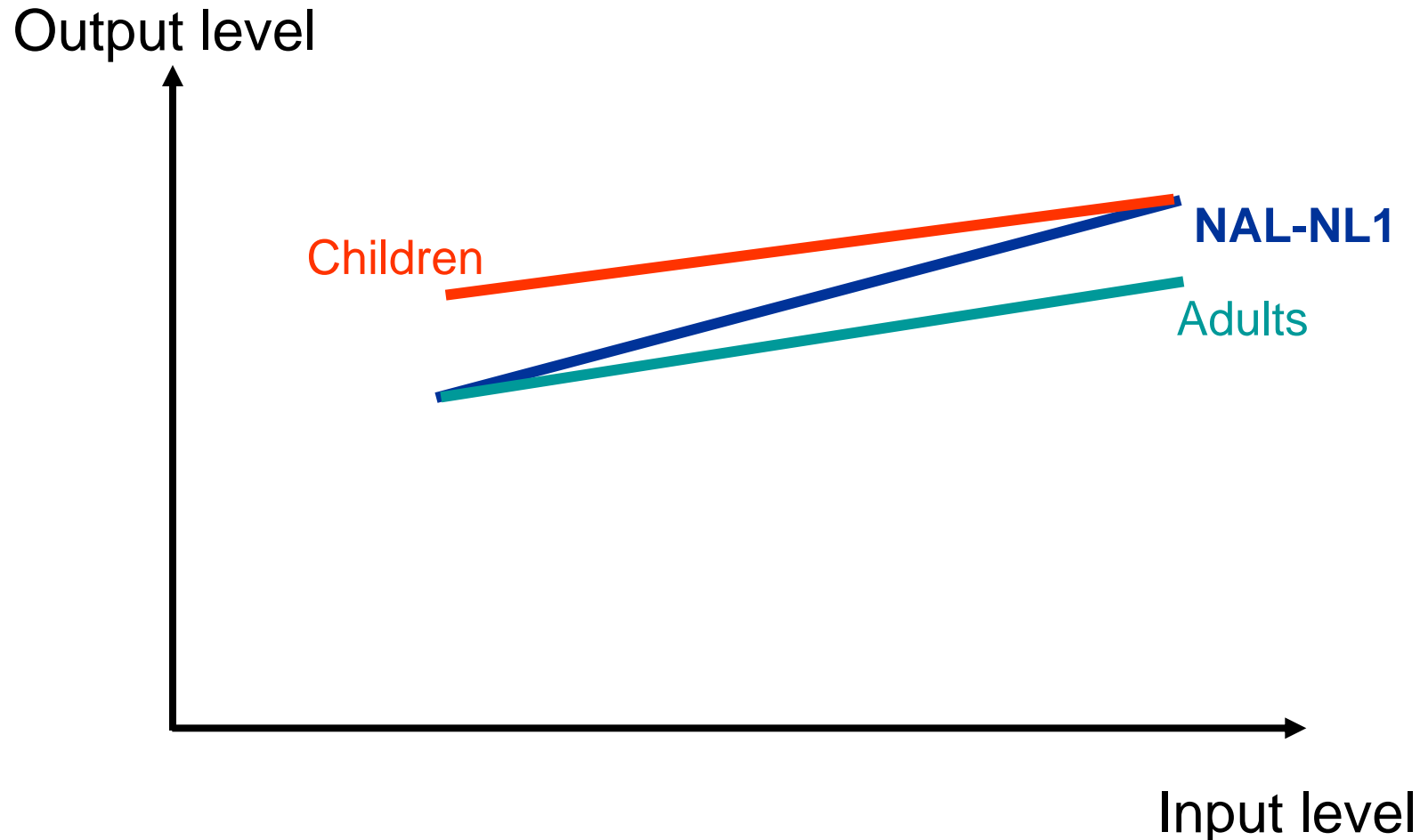


# Binaural loudness correction

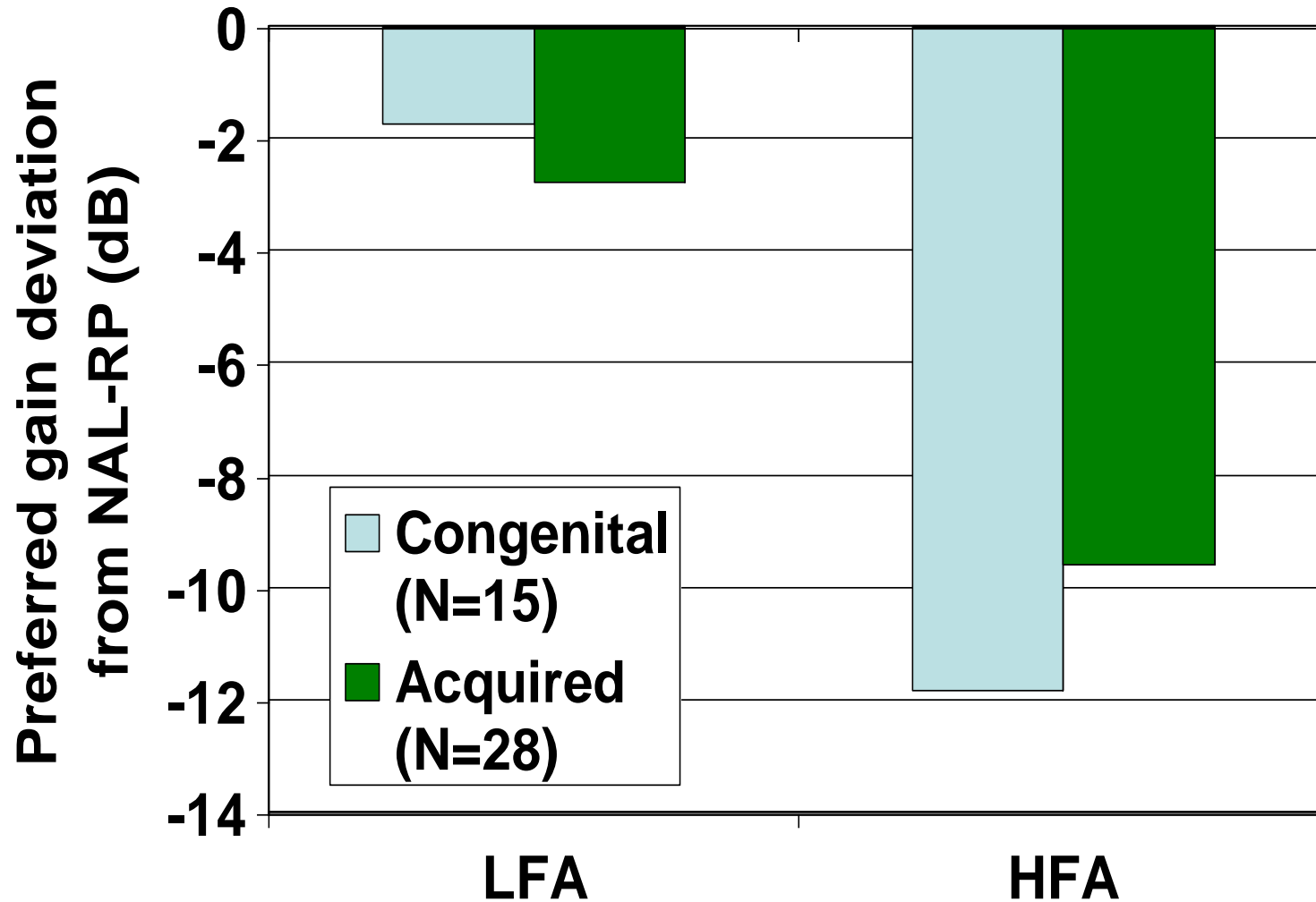




# Empirical evidence: variations from NAL-NL1

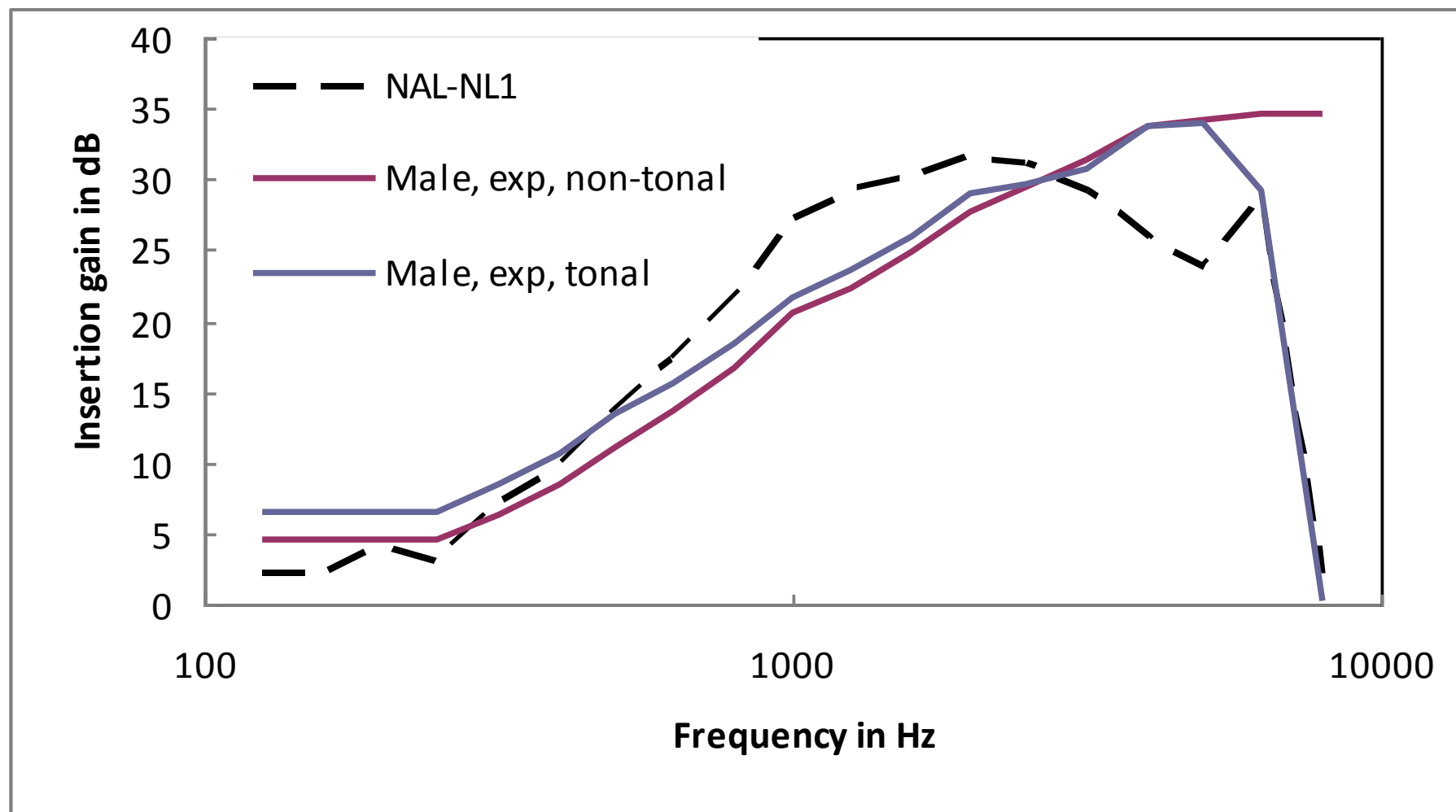


# Adults – congenital or acquired?

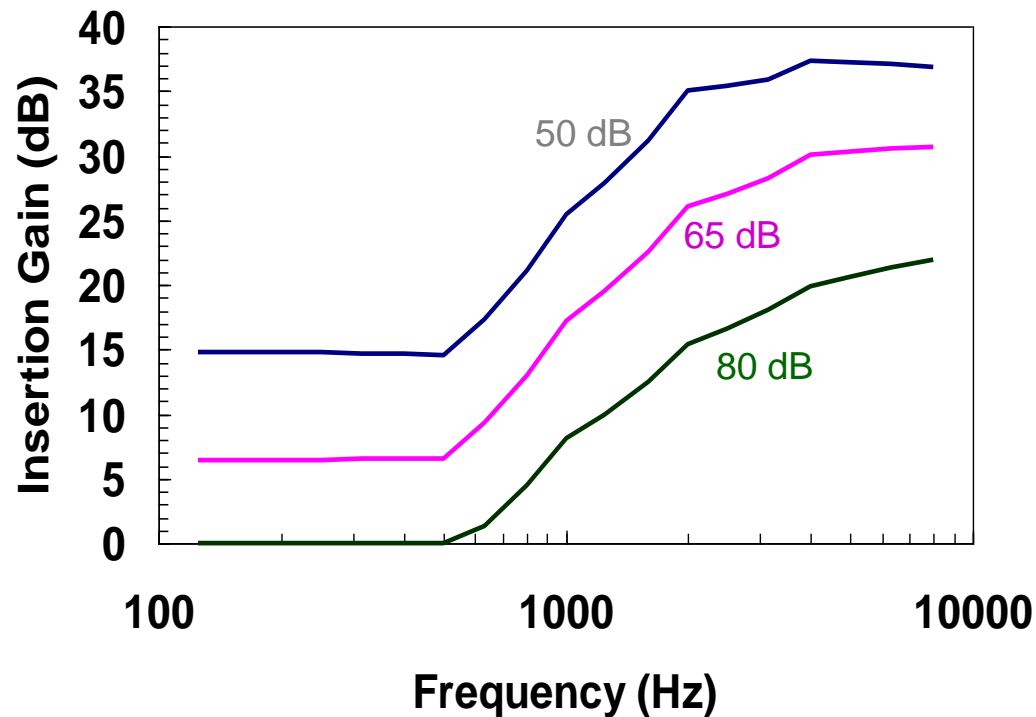
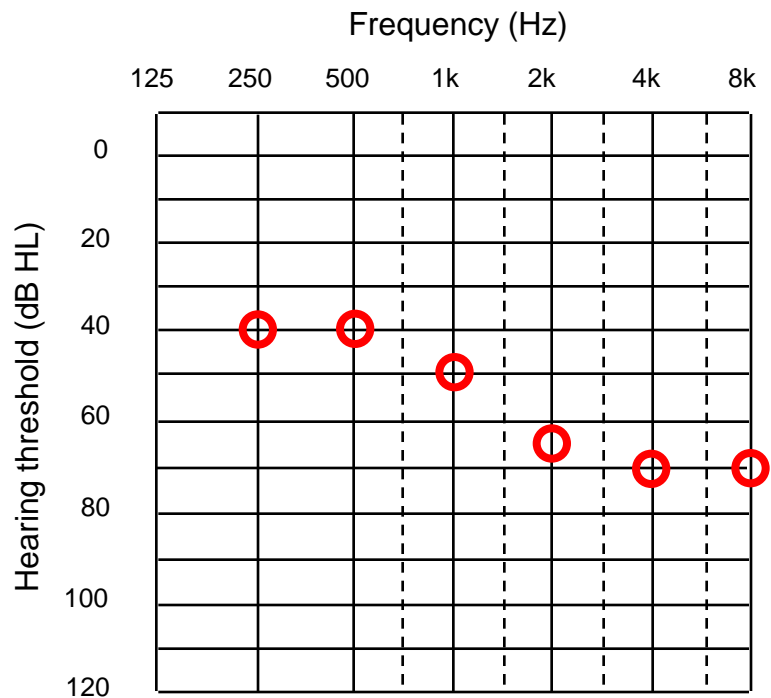


- Gain at each frequency depends on importance of each frequency
- Low frequencies more important in tonal languages
- Two versions of NAL-NL2
  - Tonal languages
  - Non-tonal languages

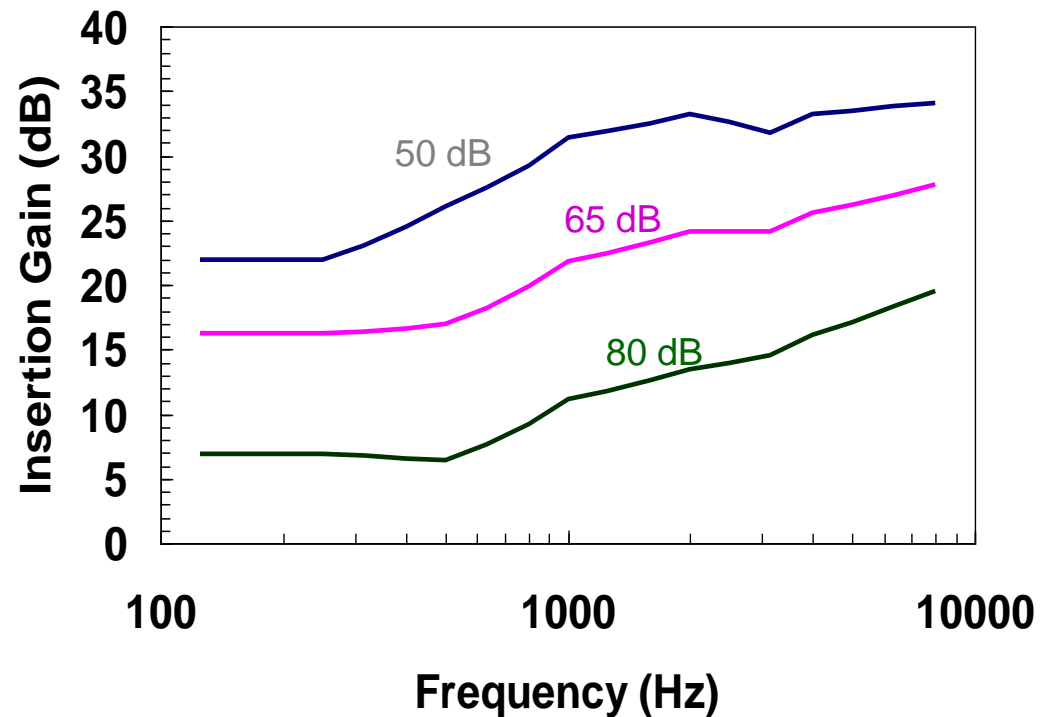
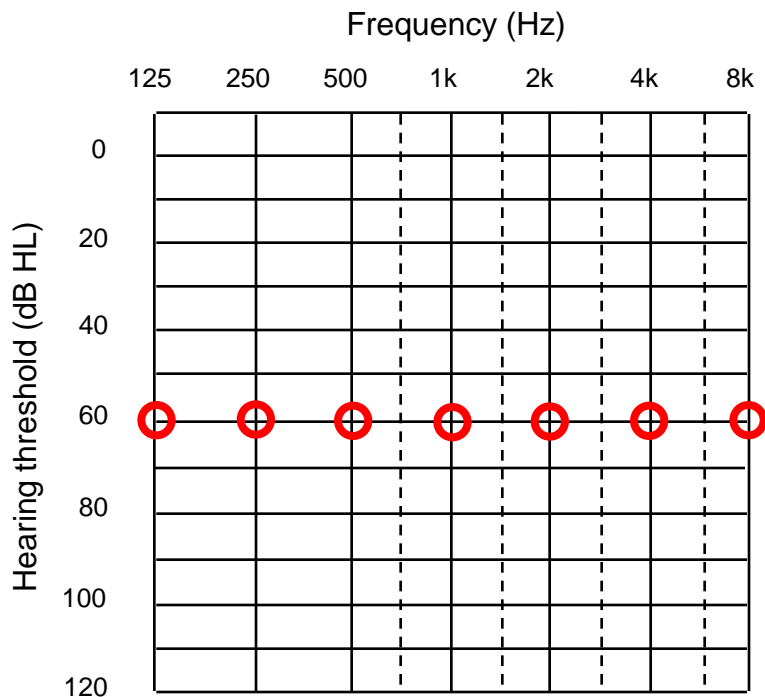
# Tonal versus non-tonal language



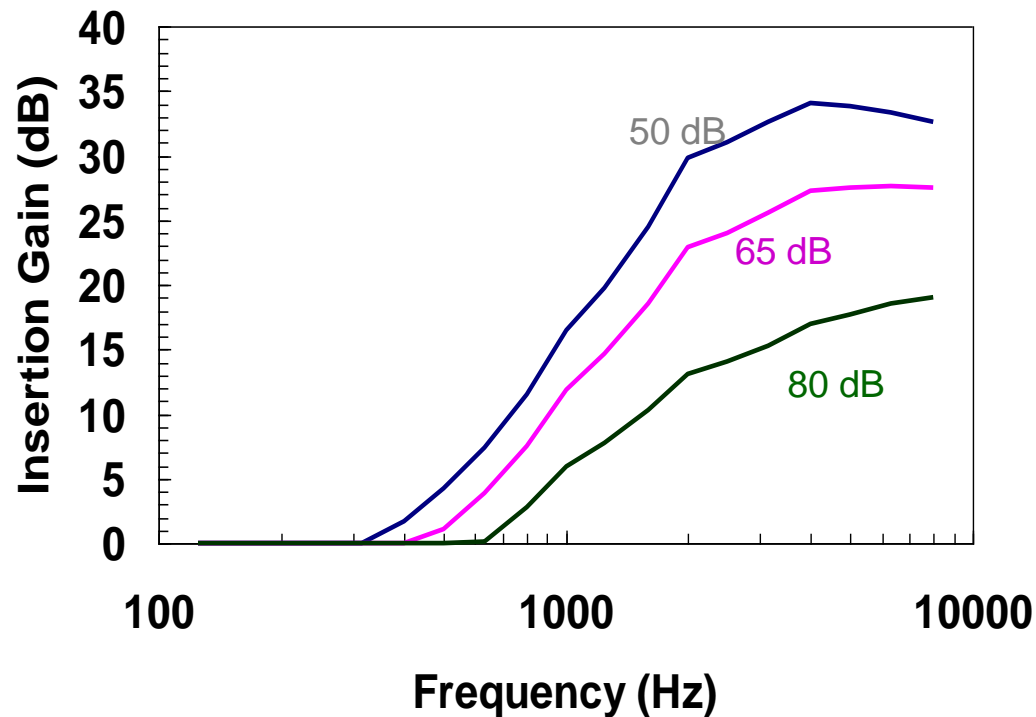
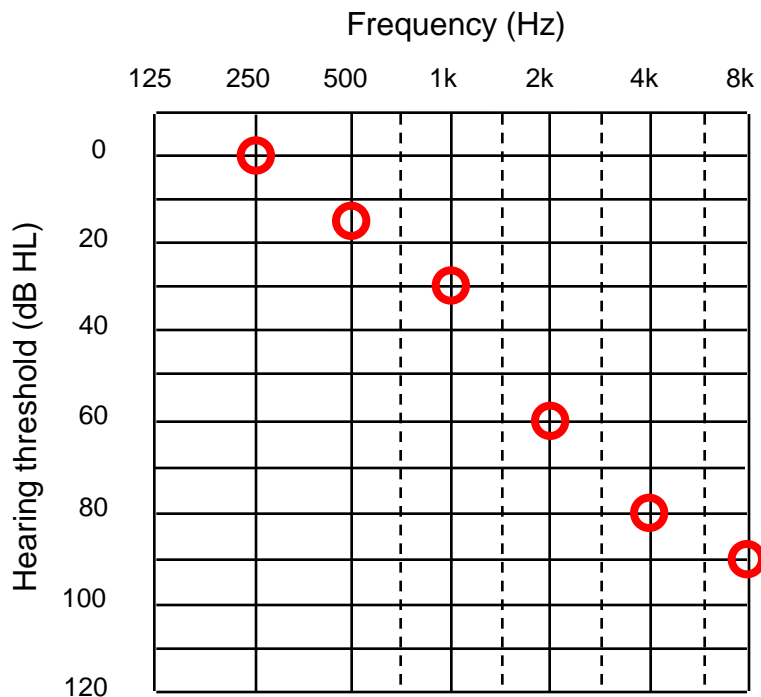
# Example audiogram: moderate sloping



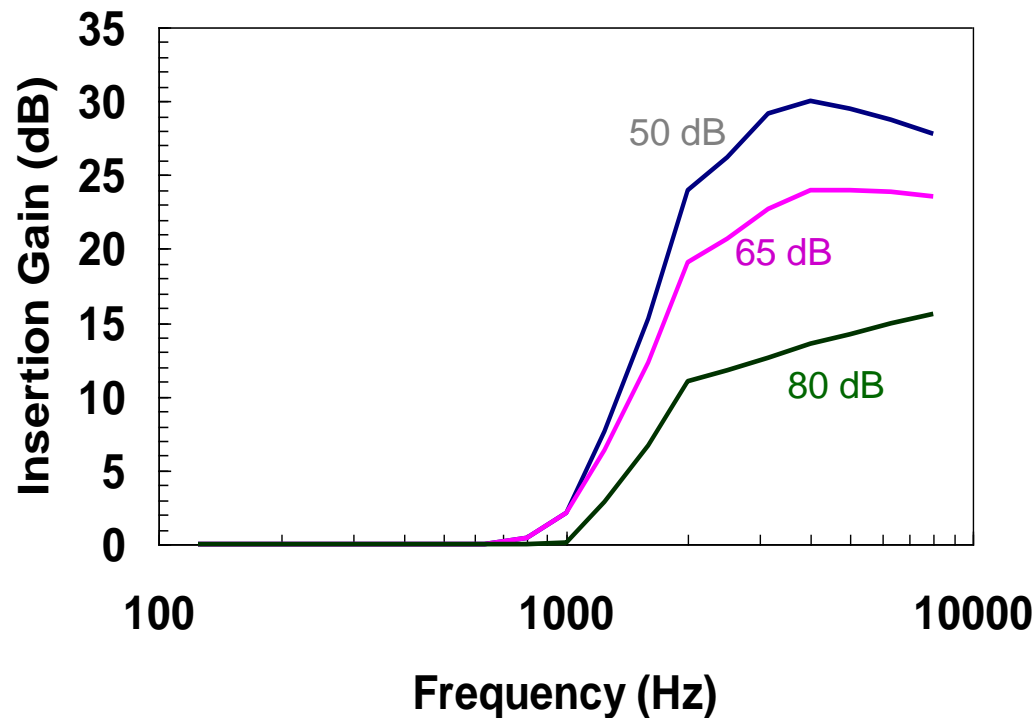
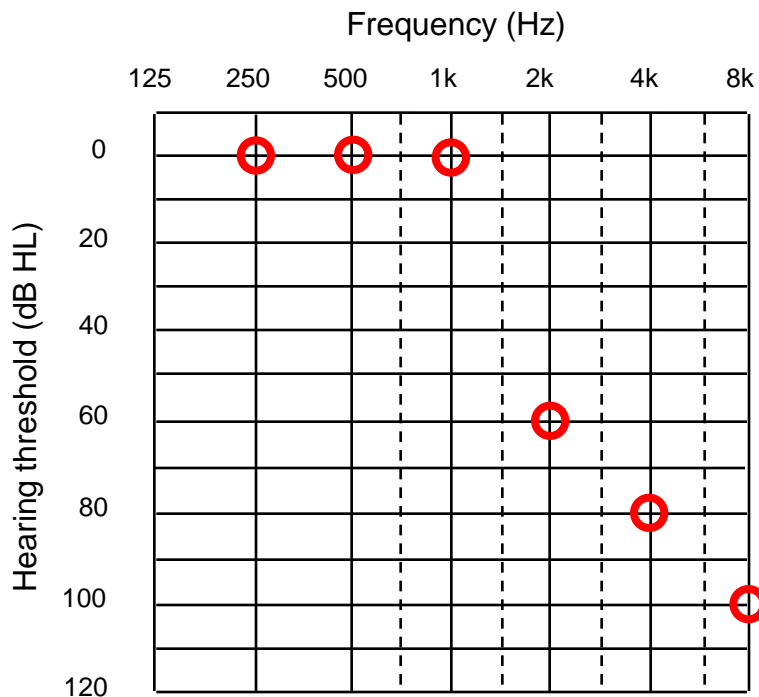
# Example audiogram: flat 60



# Example audiogram: steeply sloping

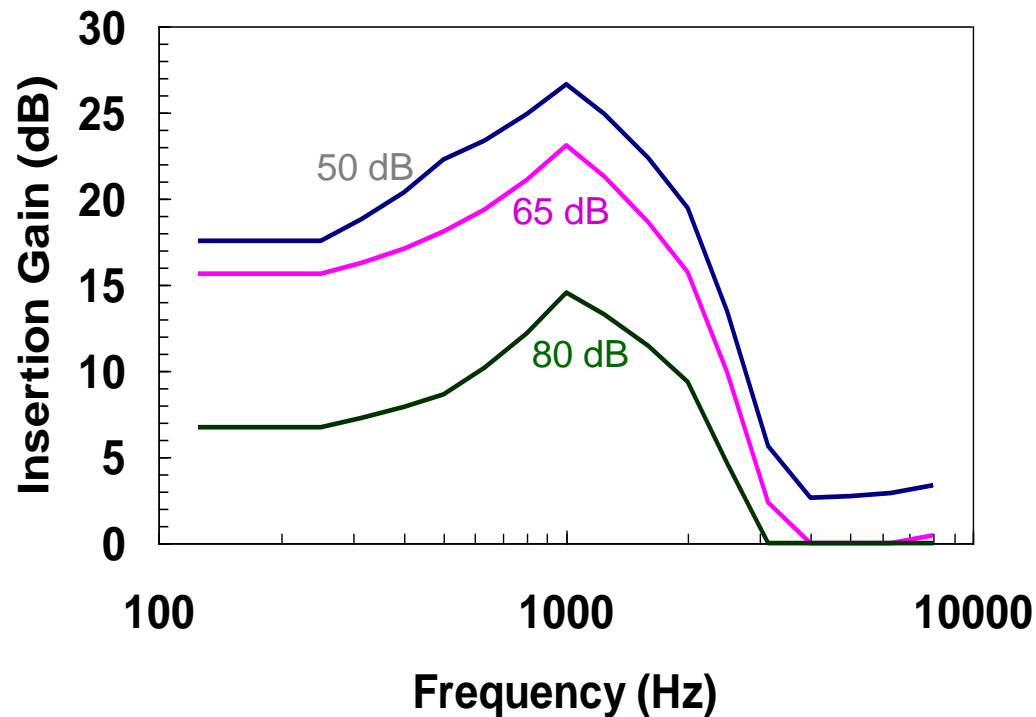
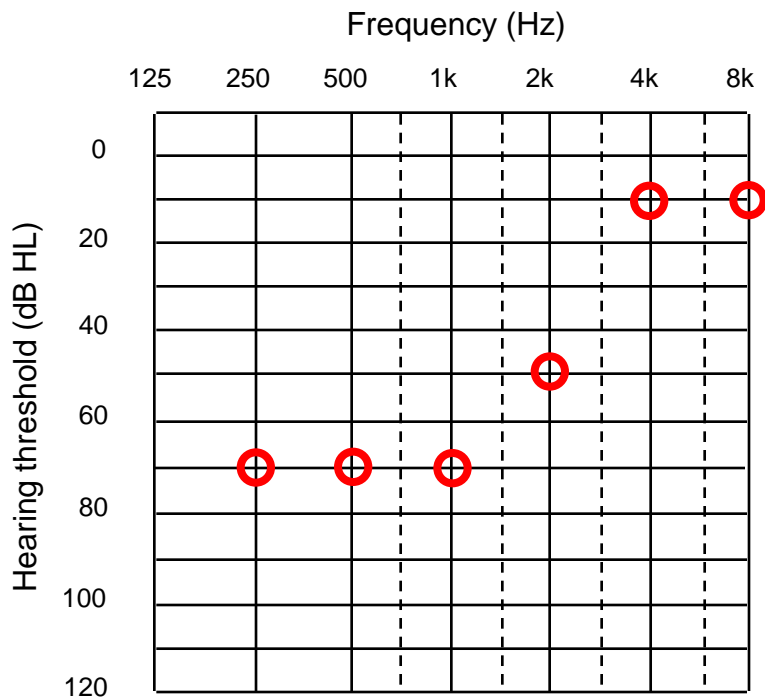


# Example audiogram: extreme ski-slope





# Example audiogram: reverse sloping





“A challenge for the profession is to devise fitting procedures that are scientifically defensible and the challenge for the individual audiologist is to choose the best procedures from whatever are available”

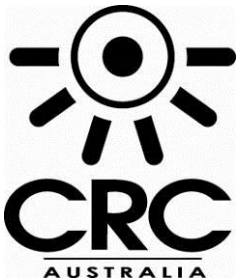
Denis Byrne, 1998

# Thanks for listening

## Acknowledgements

[www.hearingcrc.org](http://www.hearingcrc.org)

[www.nal.gov.au](http://www.nal.gov.au)



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