Complex versus Standard Fittings: Part 2

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Oticon, Inc.

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Learning Objectives

- Describe the concept of Exception Discovery and how it can lead to alternative treatment strategies.
- Explain how fitting to remaining hearing as opposed to hearing loss may improve ski-slope, rising and irregular audiograms.
- Explain which factors other than audibility may affect the response to amplification for patient with atypical audiogram shapes.

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Why?

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Exception Discovery

"Young men know the rules . . . Old men know the exceptions"

Oliver Wendell Holmes

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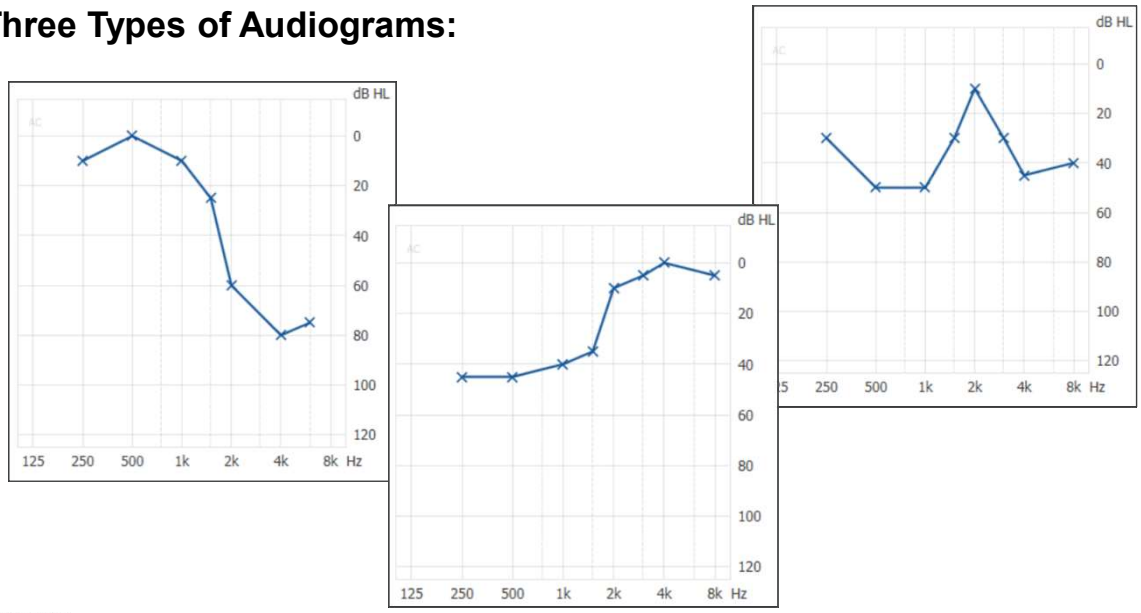
Three Types of Audiograms:



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Assumptions when fitting hearing aids:

- Prescriptive, not Adaptive
- Restore Audibility
- Correct for Threshold Loss
- Measurable Hearing is Useable Hearing
- Make the Full Range of Inputs Fit
- The More Bandwidth the Better
- All Speech is Valuable*
- Targets are the Sweet Spot
- Fine Tuning is a Movement Away from Optimal
- Fit to Intelligibility, Fine Tune to Satisfy Sound Quality
- Both Ears Contribute (Equally)
- Two Monaural Fittings

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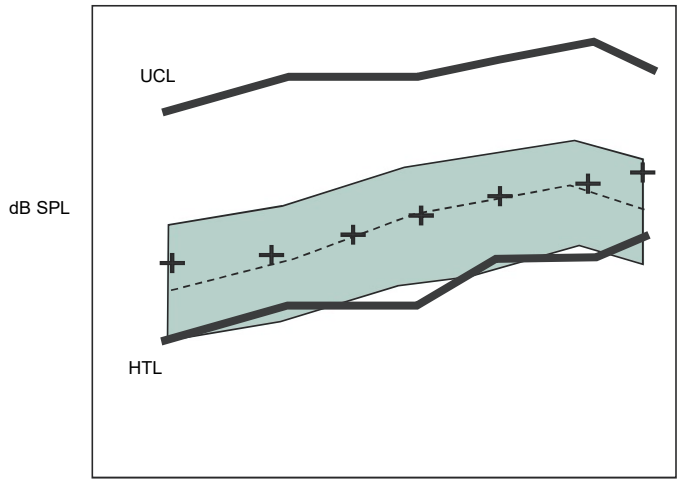

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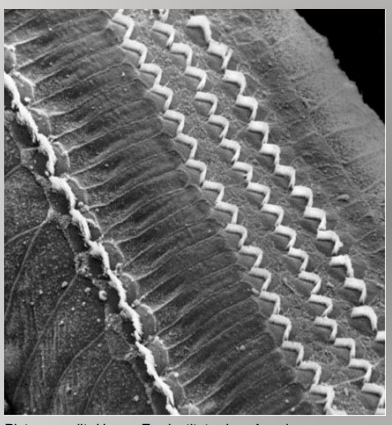
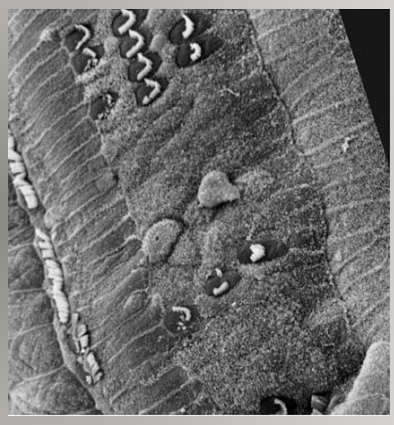
Sensorineural Hearing Loss:
Loss of Hair Cell Function

Intact cochlea





Damaged cochlea

Picture credit: House Ear Institute, Los Angeles

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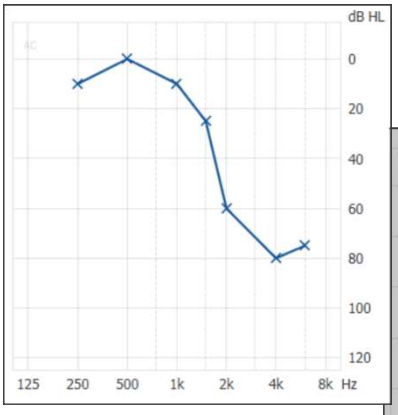

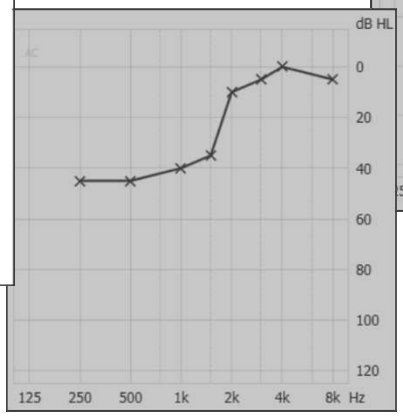

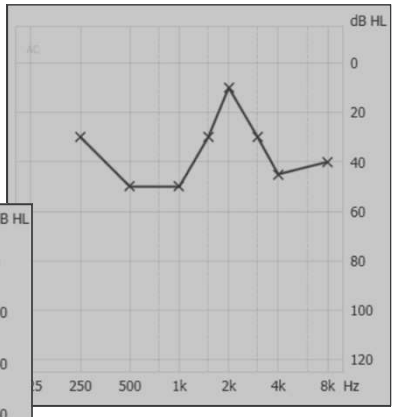

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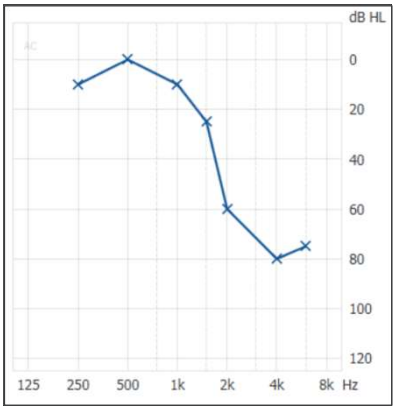
Ski-slope Losses: Key Research Findings

- Beyond moderate SNHL in HF, improved audibility may not always improve speech understanding
- At times, attempts at full audibility may decrease speech understanding



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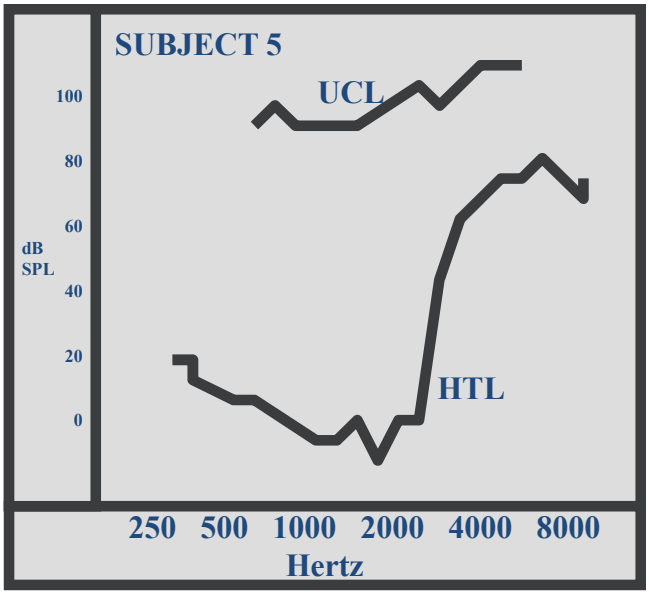

Skinner (1980)

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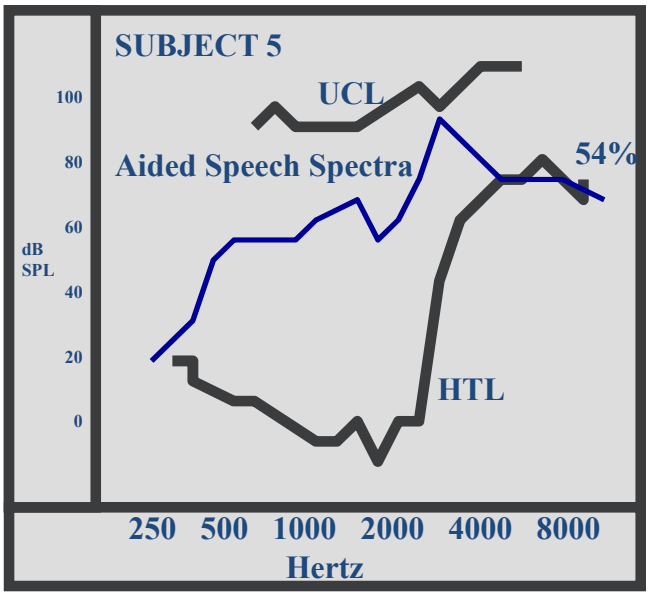

Skinner (1980)

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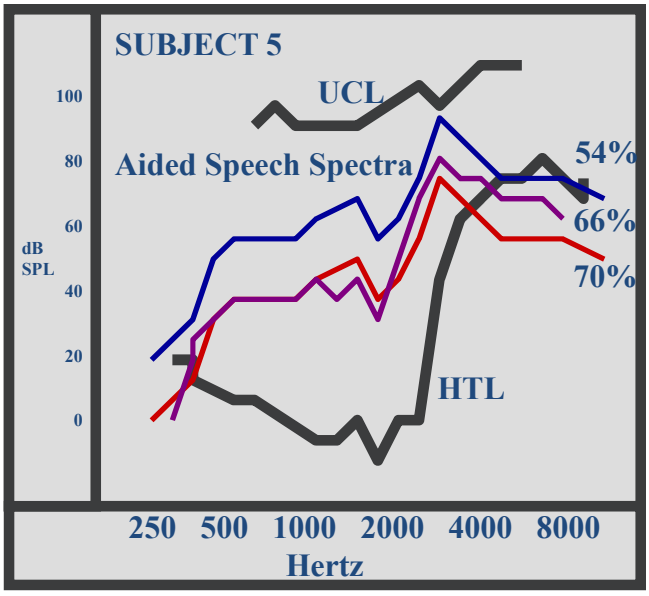

Skinner (1980)

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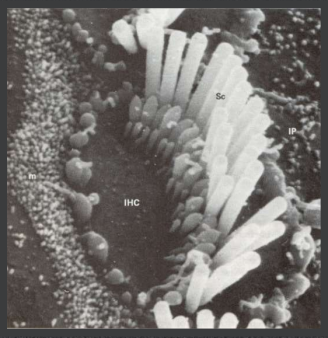

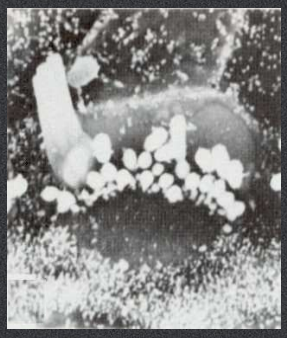

Yost & Nielsen, 1985

Normal Damaged

Dead Zones?

Goals of Ski Fitting

- Who is the patient?

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Goals of Ski Fitting

- Who is the patient?
- …
- Maintain comfort
- Maintain acceptable sound quality in quiet
  - no dramatic frequency responses
  - vented fitting
- ***Modest audibility enhancement***
  - ***focused on transition region***
  - will be appreciated in quiet
  - may be quite helpful in noise

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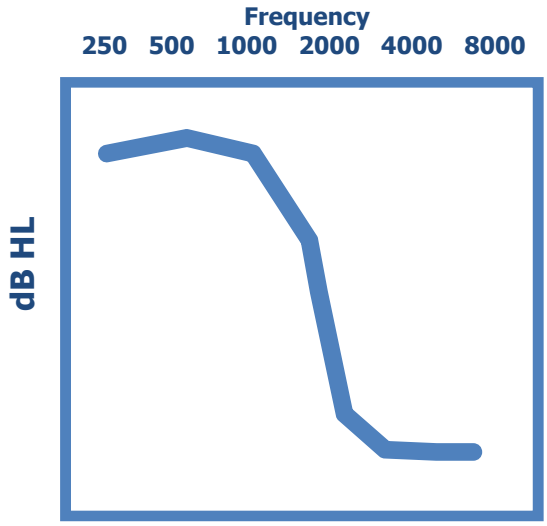
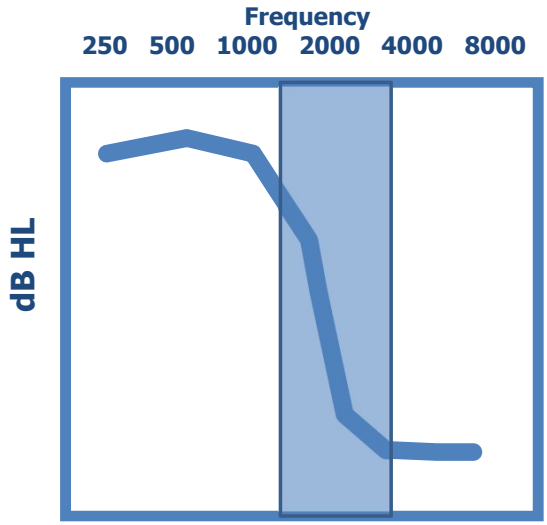
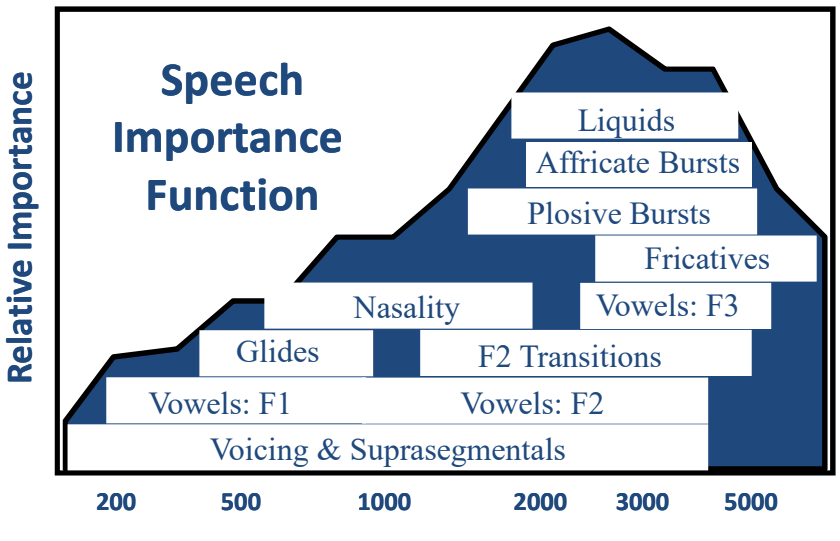
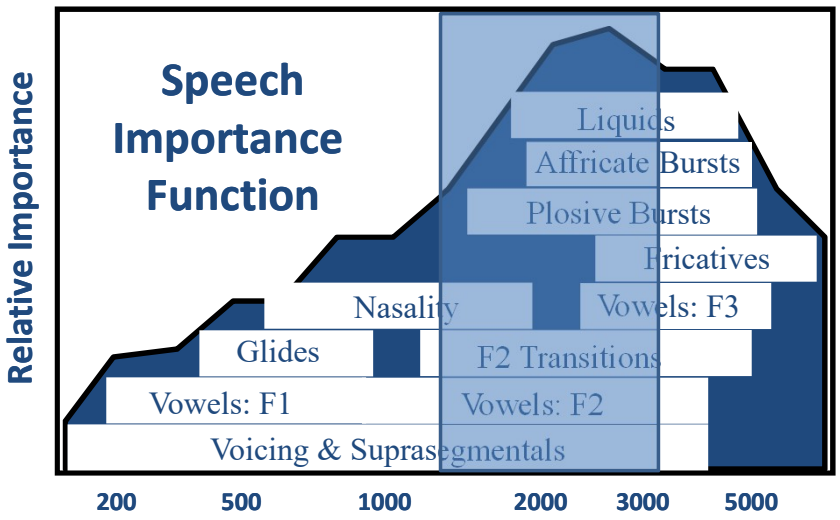
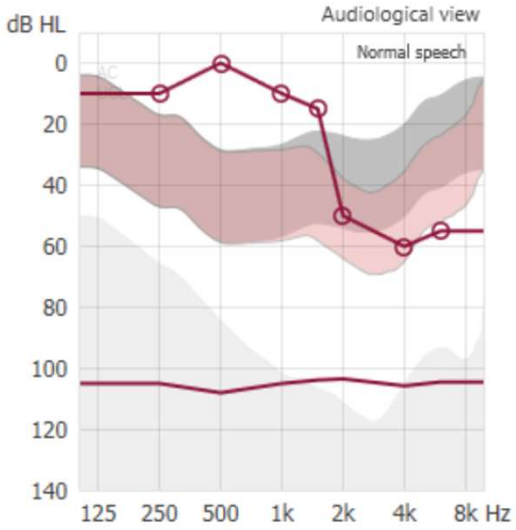



Frequency
250 500 1000 2000 4000 8000
dB HL


Speech Importance Function
Relative Importance
Liquids
Affricate Bursts
Plosive Bursts
Fricatives
Nasality
Vowels: F3
Glides
F2 Transitions
Vowels: F1
Vowels: F2
Voicing & Suprasegmentals
200 500 1000 2000 3000 5000





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Two Sound Sources

Frequency Lowering?

Advanced Signal Processing?

Three Types of Audiograms:

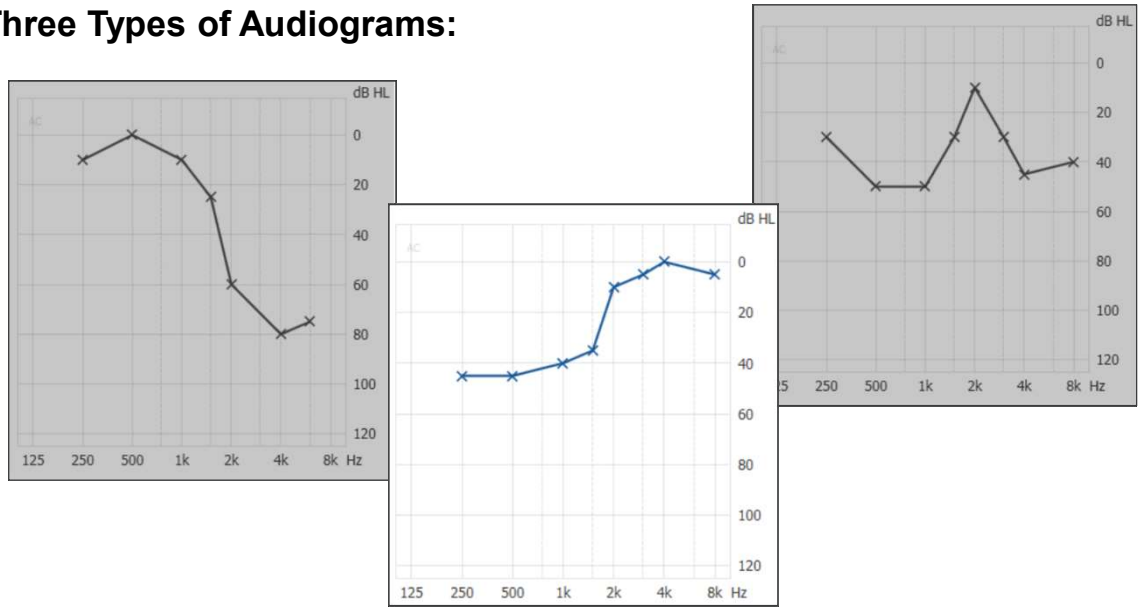

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FIGURE 7. Probe-tube measured insertion gain attained by subject PD in December 1989.

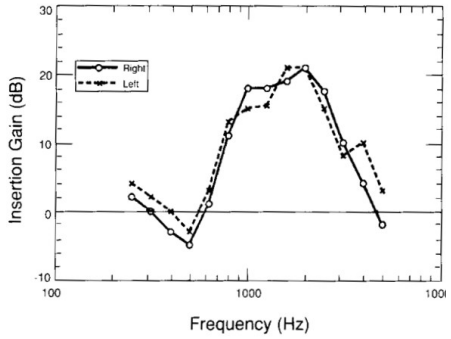
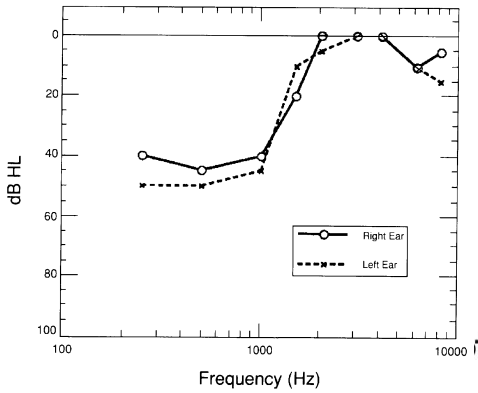


FIGURE 5. Audiogram for subject PD from Collins, Schum, Yanda, & Fryauf-Bertschy (1985).



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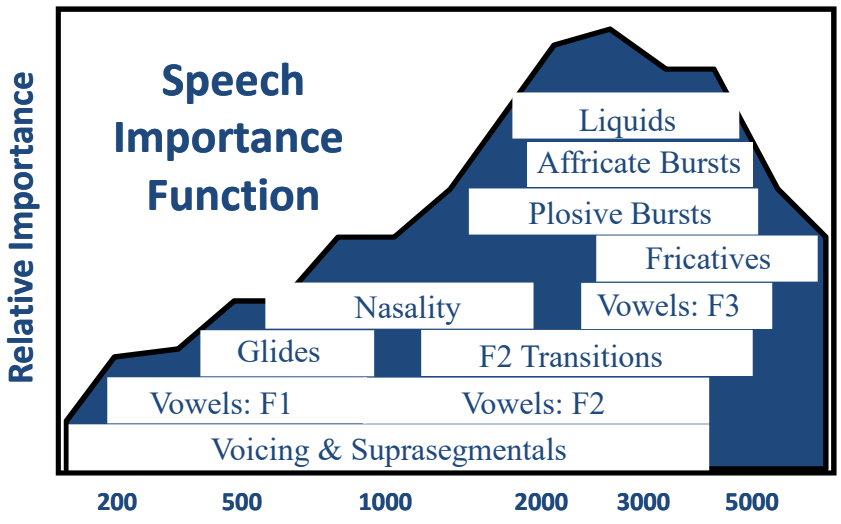
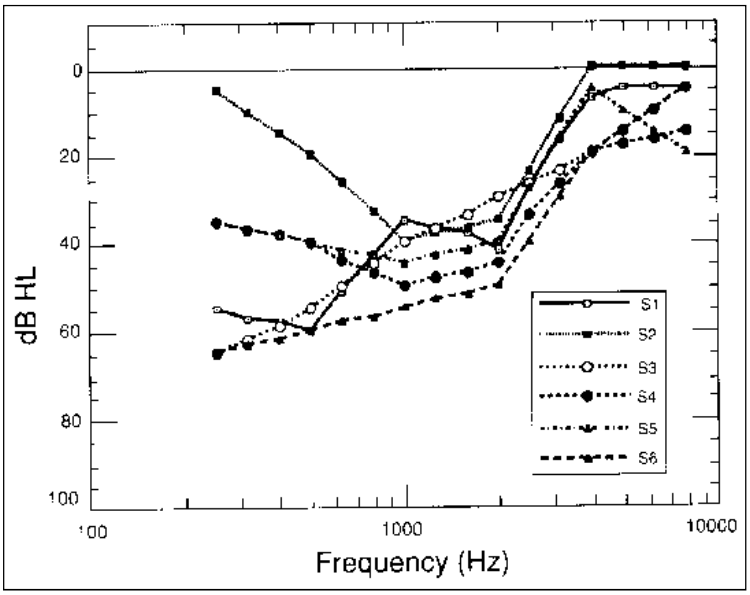
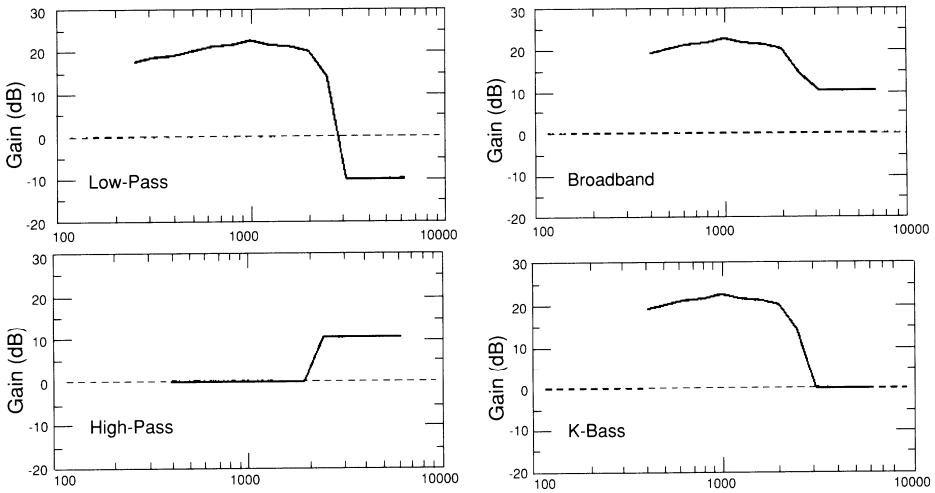
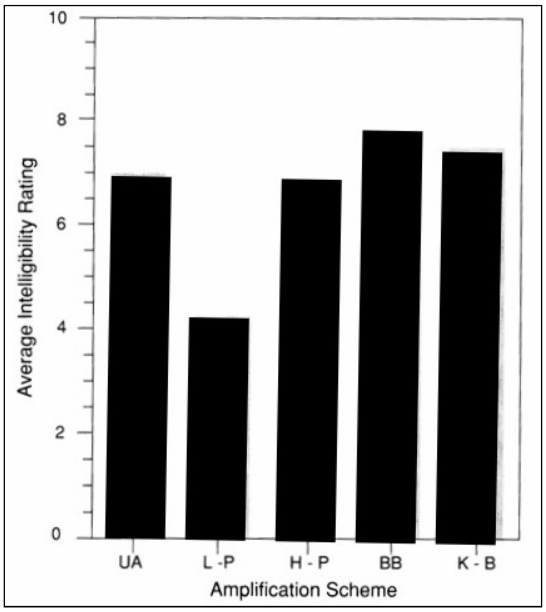




Schum & Collins, 1992

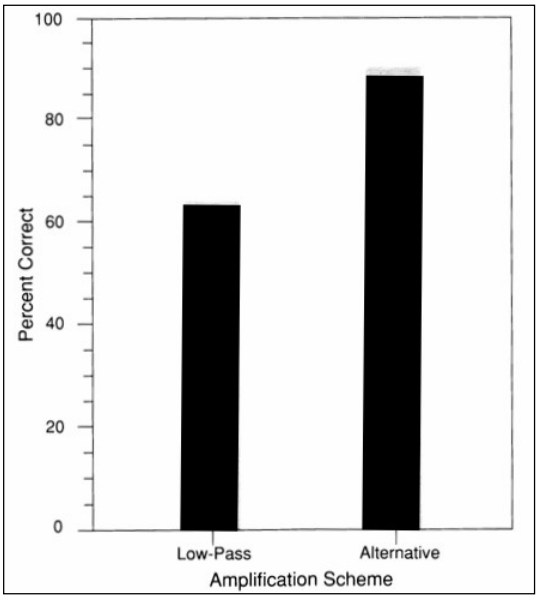


Schum & Collins, 1992



Average Intelligibility Ratings

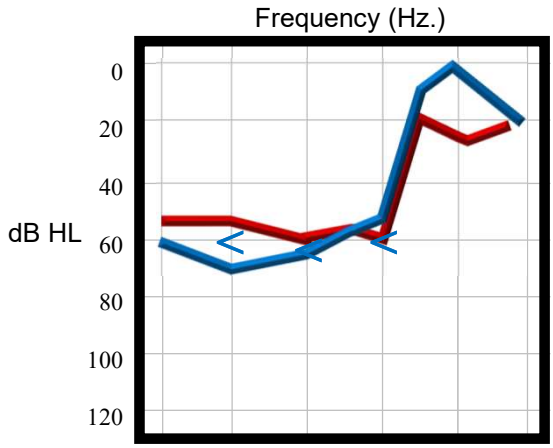
Schum & Collins, 1992



High Frequency Consonant Discrimination Scores

Schum & Collins, 1992

How should the frequency response be set?



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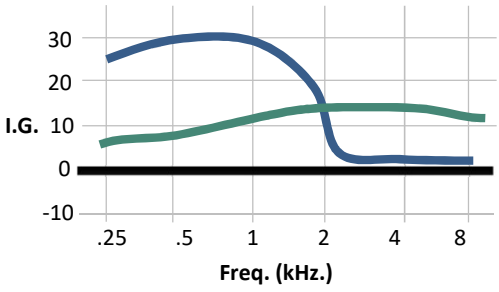
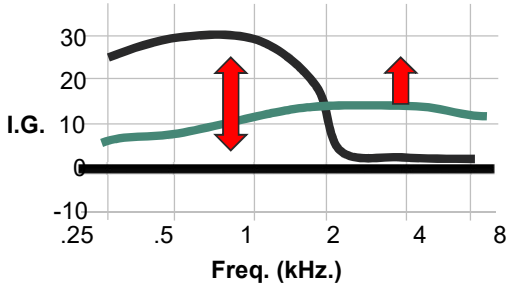
Adjustments?

- HF region (>2 kHz): at least 10-15 dB Insertion Gain
- LF & Mids Region (<2 kHz): no more than 15-20 dB Insertion Gain (likely less)



Fine Tuning?



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Advanced Signal Processing?

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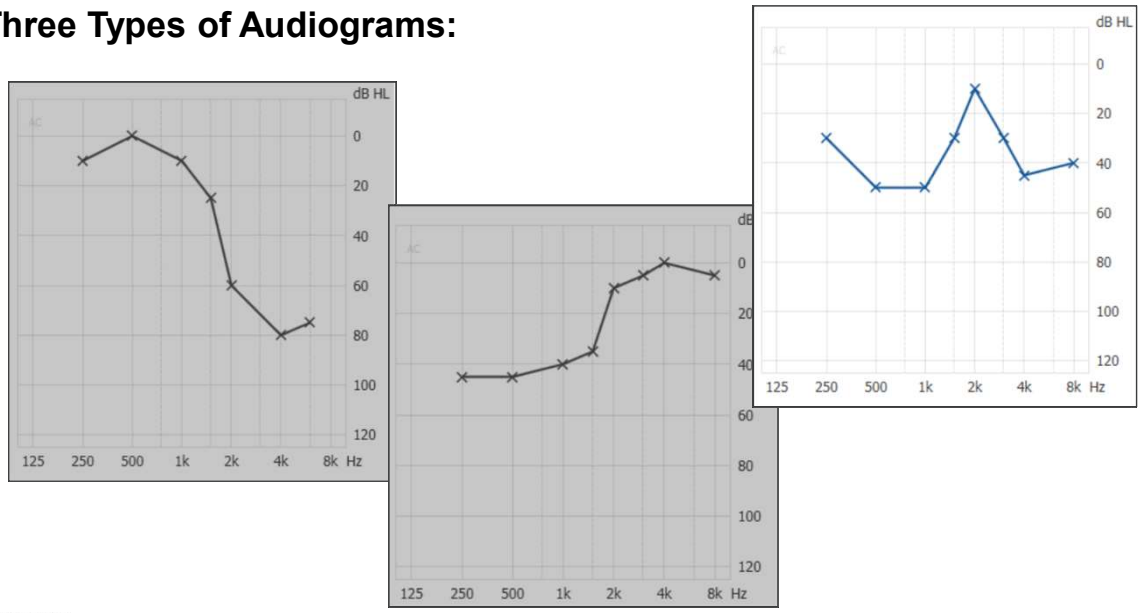

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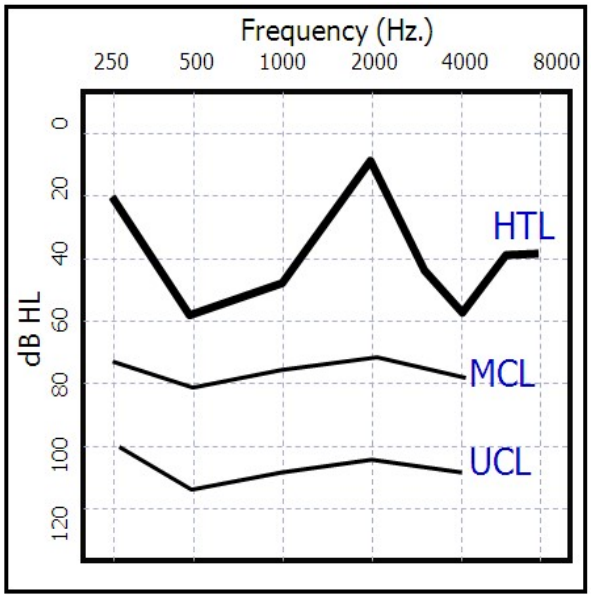

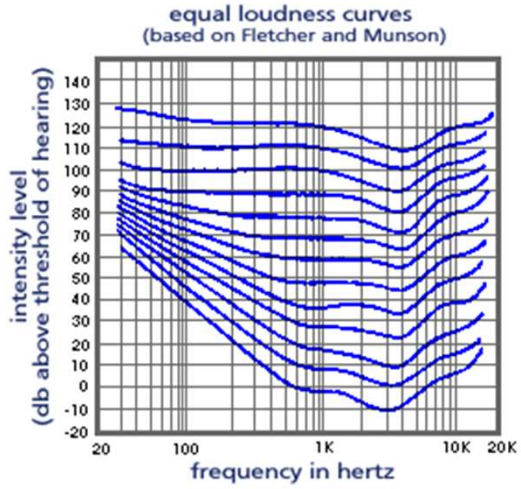

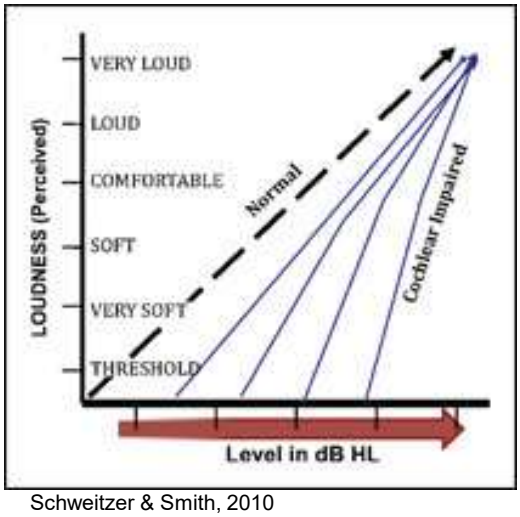

Schweitzer & Smith, 2010

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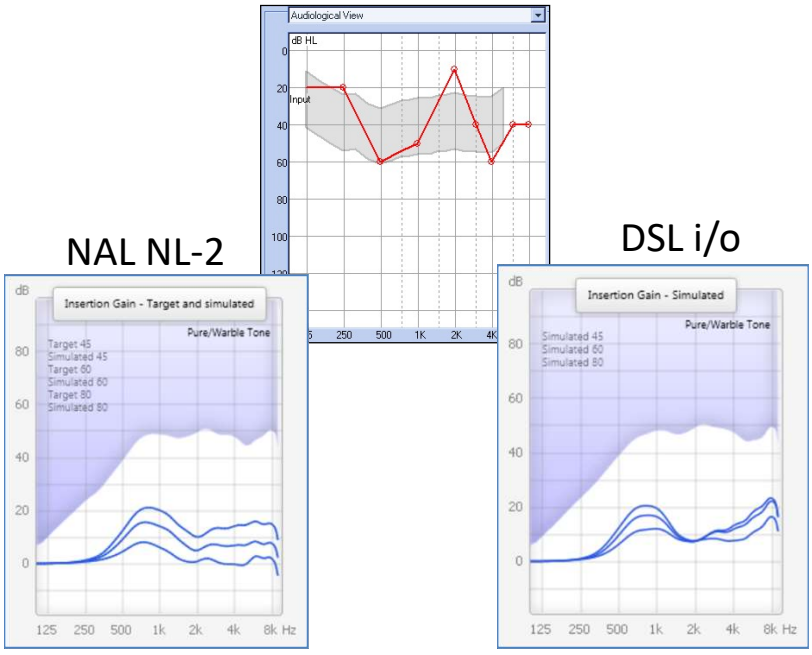
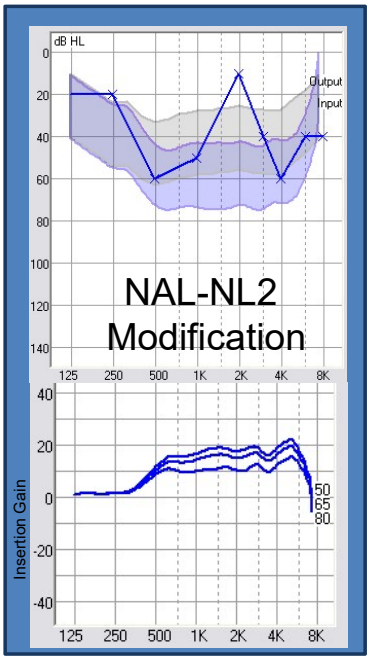
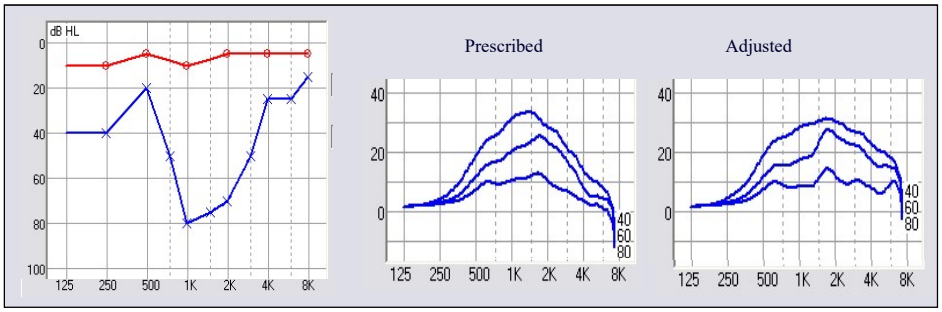



dB HL
Output
Input
NAL-NL2
Modification
Insertion Gain
50
65
80
125 250 500 1K 2K 4K 8K


dB HL
Prescribed
Adjusted
40
60
80
125 250 500 1K 2K 4K 8K

Advanced Signal Processing?

Residual Capabilities

Aided signal viewed in relation to remaining auditory abilities

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Exception Discovery

When do you let go of the “rules”?

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