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BIMODAL FITTING STRATEGIES

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DISCLOSURE AND AUTHOR CONTACT INFORMATION

• THE AUTHORS HAVE NO RELEVANT FINANCIAL OR NONFINANCIAL RELATIONSHIPS RELATED TO THE CONTENT OF THIS PRESENTATION.


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### Benefits of Binaural Hearing

- Why do we listen with two ears?
  - 3-dimensional hearing
    - Improved speech understanding in noise (e.g., MacKeith, & Coles, 1971.)
    - Enhanced localization (e.g., Durlach, & Colburn, 1978).
BENEFITS OF BINAURAL HEARING

- Binaural Summation
- Binaural Squelch
- Head Shadow Effect

Litovsky, Johnstone, & Godar, 2006

• BINAURAL SUMMATION
  - RANGES FROM 3 TO 10 dB
    (Dermody & Brynes, 1975; Hall & Harvey, 1985; Hawkins et al., 1987; Marks, 1978).

INCREASE IN PERCEIVED LOUDNESS WHEN LISTENING WITH BOTH EARS

(Moore, 2013)
**Head Shadow Effect**
- Not present at low frequencies (< 500 Hz) unless the source is very close to the head.
- Largest when the sound source is opposite one ear.
- The size of ILDs matters for localization.

**ILDS are larger at higher frequencies**

![Graph](image1.png)

**Head Shadow Effect**
- ITD/IPD
- ITDs of 100 to 500 μs convert to unambiguous phase differences at low frequencies (< 1500 Hz).

**ITDs are almost independent of frequency**

![Graph](image2.png)
**Binaural Squelch**

- CAS ability to use ILD and ITD to suppress negative effects of noise
- Average improvement of 10 dB for normal hearing subjects
- 1 to 5 dB for hearing impaired listeners (Jerger et al., 1984; Levitt & Rabiner, 1967)

**Use cues from both ears to suppress effects of noise**

**Options for Binaural Hearing**
OPTIONS FOR BINAURAL HEARING

- CI + ipsi HA
- Bilateral CI
- Bilateral Hybrid
- Hybrid + contra HA
- Unilateral CI
- Unilateral Hybrid
- Bimodal
- CI + ipsi HA, bilateral HA

LOCALIZATION?

- ILD - used primarily in the high frequencies
- ITD - used primarily in the low frequencies

What happens when there is a mismatch between frequency components?

ILD - Interaural Level Differences
ITD - Interaural Time Differences
BUT IT HAS BEEN KNOW TO HAPPEN...

(Seeber et al., 2004)

WHY BIMODAL?

- Improved music perception (McDermott, 2011)
- Improved speech recognition in quiet and noise (Morera et al., 2005)
- Localization (for some) (e.g. Seeber et al., 2004)
- More “natural” sounding (e.g. Hamzavi et al., 2004)
BILATERAL VS. BIMODAL: APPROPRIATE SELECTION

Wargo et al., 2014

READY TO GO BIMODAL

- AIDABLE HEARING
- DISCRIMINABILITY
- HA SELECTION
  - WORKING AS A TEAM
PROGRAMMING BIMODAL_LISTENERS

**CI**
- **Counseling**
- CI 1<sup>st</sup> → HA 2<sup>nd</sup>
- **Ensure that CI is programmed appropriately**
  - Verify levels using ESRT, Import for this population
  - CI → Speech understanding
  - HA → Compliment
- **Considerations for communicating across devices**

**HA**
- **Look at thresholds from CI**
- **Targets?**
- **Balancing**
  - What to do with patients who are previous users....

PARALLEL PATHS ONE BRAIN VALIDATION
REFERENCES