VERIFYING AIDED LOUDNESS PERCEPTION

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Introduction

During the verification phase of a hearing aid fitting, clinicians might wish to assess the extent to which loudness perceptions for amplified sounds are similar to those typical of normal hearers.

This type of verification calls for a criterion for "normal" loudness perception of sounds presented binaurally in a sound field.

Research on loudness perceptions has generally been performed with sounds presented monaurally via earphones.

Can we assume that loudness growth functions and/or particular loudness levels (such as "comfortable") measured monaurally under earphones will apply equally to sounds presented binaurally in a field?

This poster describes an investigation of this question.

Method

- Thirty normal-hearing adult subjects (equal gender distribution), without previous exposure to loudness testing.
- The Contour test was used to measure loudness growth functions.
- Stimulus = 5 second samples of single-talker speech (because modern instruments often process speech differently from other sounds, it is important to use real speech as the test stimulus).
- Stimulus increment = 5 dB, always ascending.
- Tested listening conditions are shown below.
- Earphone conditions were presented using ER3A insert phones.
- Sound field conditions were presented from a zero-degree azimuth in a sound-treated room.
- The speech spectrum was shaped to be equal at the average eardrum in both earphone and sound field listening.
- All subjects received all conditions.

Listening Conditions

Earphone:
- monaural broad band
- binaural broad band
- binaural low pass
- binaural high pass

Sound Field:
- monaural broad band
- binaural broad band
- binaural low pass
- binaural high pass

HARL
Hearing Aid Research Lab.
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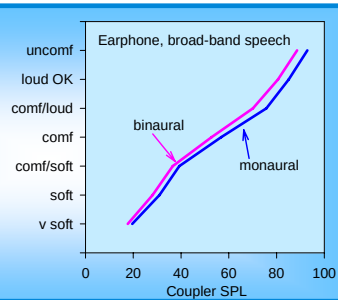
Results

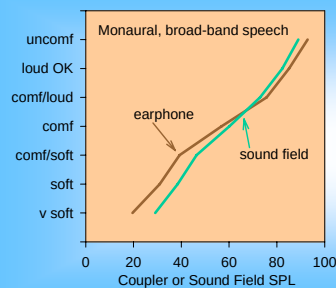
I. Effect of binaural listening:

- A given sound is slightly louder when perceived binaurally.
- This result is consistent across all loudness levels.



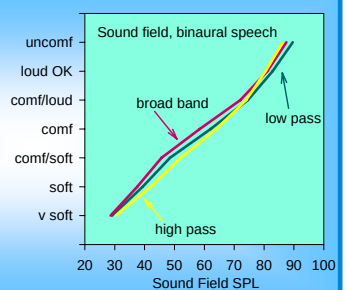
II. Effect of sound field listening:

- Loudness grows more rapidly for sound field listening.
- The softest sounds are higher in level than for earphone listening.
- The loudest sounds are lower in level than for earphone listening.



III. Effect of frequency response:

- The loudness growth function for low pass speech is parallel to broad band speech, but slightly lower in level (less loud).
- The loudness growth function for high pass speech is more steep than that for broad band speech, especially through the upper loudness categories.



Conclusions Q & A

Q. Can I use loudness norms generated by listening under earphones for verification of aided loudness perception?

A. No. It looks like you need to use norms that were obtained in sound field listening.

Q. Can I use norms that were obtained with monaural listening when I am verifying a binaural fitting?

A. Yes. You can use the monaural norms if you apply about a 3.0 dB correction to account for binaural summation of loudness.

Q. Can I use norms for listening to broad-band speech when the hearing aid has a narrower bandwidth?

A. Yes - if the bandwidth restriction is mainly due to high frequency reduction. The narrow-band speech will be a bit less loud, so you need to correct the broad-band norms by about 2 dB.

Q. Does the hearing aid's frequency shaping affect loudness growth?

A. Yes. Speech with a strong high-frequency emphasis has a steeper loudness growth function than flat, broad band speech.

Q. What else do I need to keep in mind?

A. These data were obtained with the Contour test (Ear & Hearing, 1997, p388-400). Other loudness test protocols would probably give similar results, but we don't know this for sure.

Q. Can I use Contour test norms with other loudness test protocols?

A. No. Each loudness test protocol produces slightly different data. Use norms that were generated with the loudness test protocol you like to use.