The Situational Hearing Aid Response Profile (SHARP) Version 7

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Introduction:

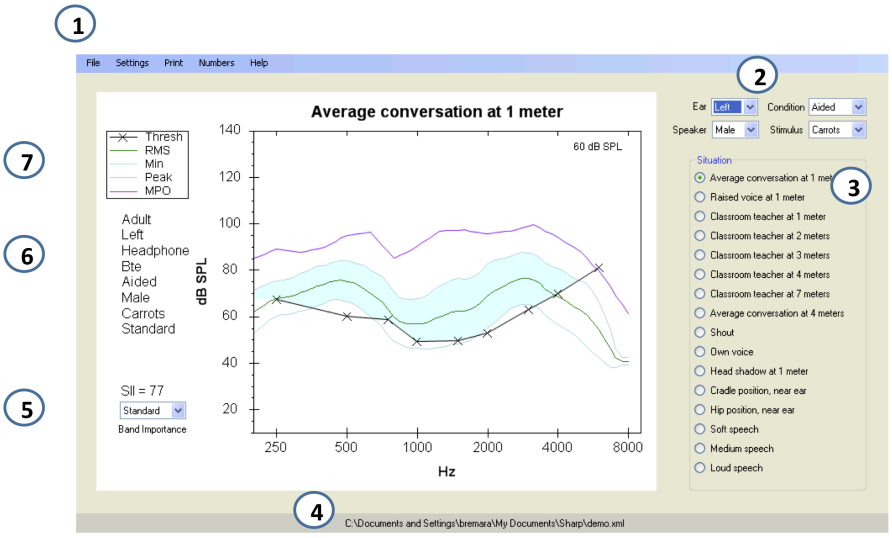
The Situational Hearing Aid Response Profile (SHARP) was originally developed by Pat Stelmachowicz and colleagues at Boys Town National Research Hospital to characterize the audibility of speech signals across a wide range of realistic listening situations with varying acoustics. Version 7 represents the first update of SHARP in over a decade. Version 7 will run on Windows XP and 7. It has not been tested on Windows 8. Major updates include:

- Integration with Audioscan Verifit to read .XML data files directly into SHARP
- Prediction of input/output function in 1/3 octave bands from verification data

SHARP Installation:

1) Copy SHARP.zip file to Desktop of computer that SHARP will be installed on.
2) Double click on SHARP.zip and unzip the file into the desired location. We recommend creating a folder called C:\SHARP (or other local drive).
3) After unzipping, click on set-up. A window will open briefly.
4) SHARP will open following installation

SHARP Interface:



1. Menu System
    a. File:
        i. New: use to manually enter threshold and real-ear data. Threshold data are entered in dB HL, RECD values in dB, otherwise data are entered in dB SPL.
        ii. Open: use to select the location of a Verifit .XML file. This can be either a local drive or network location.
    b. Settings: Use to select how the figure is displayed
    c. Print: use to print the figure to a printer or to disk
    d. Numbers: use to see a table of the predicted output levels
    e. Help: location of this manual
2. Option selection –

    a. Ear: Selects the left or right ear from the Verifit file.
    b. Male: Toggle between male, female and child talker
    c. Condition: Toggle between unaided and aided speech spectra.
    d. Stimulus: Selects the stimulus (Carrots, Ear, ISTA, Female) used from the Verifit file.
3. Situation – Allows selection of different input spectra (See Speech Spectra section for a description of each spectrum).
4. Location and name of the Verifit file
5. SII – Speech Intelligibility Index. The SII represents the proportion of the speech signal that is above the listener's threshold. The SII was modified from the ANSI (2007) standard to incorporate the dynamic range of speech after amplification. The user can select the band importance function used to compute the SII. The band importance function defaults to the ANSI (2007) standard band importance function for calculating audibility. Nonword and sentence importance weights can also be selected. Standard should be used for everyday listening situations. Nonword or sentence importance weights should be used when interested in predicting performance with tests that use nonwords or sentences. The SII is automatically recalculated each time you change the band importance function. Note that sometimes the value will not change.
6. Displays the current settings.
7. Figure legend.

Estimation of the Hearing-Aid Output:

The hearing-aid output for the different listening situations is estimated using the following procedure:

- The input spectra for the different listening situations were interpolated from $^1/_3$ to $^1/_{12}$ octave bands.
- Sharp imports the minimum, RMS, and peak hearing-aid output levels. The levels are specified in $^1/_{12}$ octave bands from 200 to 8000 Hz.
- For each $^1/_{12}$ octave band Sharp conducts a linear regression where the independent variable is the input level and the dependent variable is the output level.
- The y-intercept and slope are used to predict the hearing-aid output for each $^1/_{12}$ octave band. The independent variable is the input level for the selected listening situation and the dependent variable is the output level.
- Accuracy of the estimated hearing-aid output using Sharp was described in Brennan et al. (2012) and this conference proceeding is available for download from http://audres.org/rc/.

Computation of HL to SPL:

The conversion from HL to SPL depends on the method used to enter the real-ear data. For real-ear data that are entered via the Verifit, the dB SPL values computed by the Verifit are used. For real-ear data that are entered manually the dB SPL values are computed using the following procedure:

TDH. The same procedure is used to convert HL to SPL for children and adults. Thresholds in dB HL are converted to dB SPL by adding the values from the column labeled TDH 49/50 in Table 5 of the ANSI (2010) standard.

Inserts. First thresholds in dB HL are converted to dB SPL in a 2 cc coupler, using Table 7 (column labeled HA-2 with rigid tube) from the ANSI (2010) standard. For adults and children the levels in the 2 cc coupler are converted to real-ear levels by use of the linear regression equations described in Bagatto et al (2002).

Speech Spectra:

In SHARP version 7.0, 16 different speech spectra are available, as described below.

The number in parentheses indicates the rms level of the signal. The 1/3-octave band levels

associated with these spectra are shown in Table A-6 & Fig. A-1 of Appendix A.

1) Average conversation at 1 meter (60 dB SPL) - from Cox and Moore (1988).

2) Raised voice at 1 meter (70 dB SPL) – spectrum from Cox and Moore (1988) but adjusted to an overall level of 70 dB SPL.

3) Classroom teacher at 1 meter (72 dB SPL) - from Pearsons et al (1977). "Loud speech" was averaged across males and females (Figs. 16 & 17) and rescaled to an overall level of 72 dB SPL.

4) Classroom teacher at 2 meters (66 dB SPL) - as above from Pearsons et al (1977).

5) Classroom teacher at 3 meters (63 dB SPL) - as above from Pearsons et al (1977).

6) Classroom teacher at 4 meters (61 dB SPL) - as above from Pearsons et al (1977).

7) Classroom teacher at 7 meters (61 dB SPL) - as above from Pearsons et al (1977).

8) Average conversation at 4 meters (48 dB SPL) – spectrum from Cox and Moore (1988) but scaled

down 12 dB from the 1 meter values (#1), representing a change from 1 meter to 4 meters

based on the inverse square law. This assumes conversation in a non-reverberant field

such as outdoors or in a large indoor area (gymnasium).

9) Shout (82 dB SPL) - from Pearsons et al (1977).

10) Own voice (70 dB SPL) - from Cornelisse et al (1991). Values represent mean of adult male, adult female, and children.

11) Head shadow at 1 meter (60 dB SPL) - from Studebaker et al (1980). Data represent the relative difference between 90 and 270 degrees as applied to the Cox and Moore (1988) spectrum at 1 meter.

12) Cradle position, near ear (68 dB SPL) - from Stelmachowicz et al (1993).

13) Hip position, near ear (76 dB SPL) - from Stelmachowicz et al (1993).

14) Verifit Soft (Soft Speech) – (55 dB SPL) Long-term average speech spectrum for the “carrot” passage from the Audioscan Verifit.

15) Verifit Average (Medium Speech) – (65 dB SPL) Long-term average speech spectrum for the “carrot” passage from the Audioscan Verifit.

16) Verifit Loud (Loud Speech) – (75 dB SPL) Long-term average speech spectrum for the “carrot” passage from the Audioscan Verifit.

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