Hearing Corrector

Software package: Version 1.1, 28.08.14
This documentation: 03.09.14

IND - Ingenieurbüro für Nachrichten- und Datentechnik
Dr.-Ing. Peer Dahl
Keplerstrasse 44
D-75175 Pforzheim
Tel. 49-7231-650332
Fax: 49-7231-965186
eMail: P.Dahl@ind-technik.de
Internet: www.ind-technik.de

Preface

With age, by disease or due to an acoustic trauma, the Hearing decreases. In most cases the high sound frequencies are particularly affected. But even the lower or certain individual frequencies can be insensitive and disturb the sound.

About the status of the hearing the audiogram gives the information, that is eg created by the otolaryngologist.

How would it be, if your favorite music, audiobooks and any sound material would sound like before, when the hearing was still intact?

Hearing Corrector can contribute to this a large extent - in a few steps:

1. Enter your audiogram for the left and right ear, or if you do not have the audiogram, use the equalizer to subjective modification or both.

2. Load sound files in **Hearing Corrector** and

3. Calculate and store a corrected version that is compensating your hearing deficiencies.

Enjoy the new sound, which sounds like earlier days ...

We hope you enjoy using this software in new and old sound dimensions.

Content

Hearing Corrector

1 General

Hearing loss can be considered to a large extent as a filter which attenuates individual frequencies. This filter can look completely different in both ears. Ideally, the individual hearing loss is documented by a so-called audiogram. The audiogram shows the hearing sensitivity depending on the frequency. A healthy ear has a continuous frequency response near the 0 dB line. This means that the hearing sensitivity is reduced at no frequency. The more the frequency response is below the 0-dB line, the louder a sound event needs to be for the same perception.

Since the frequency response is not flat, but a curve, it is not enough to simply increase the volume, you must do this frequency selective.

Hearing Corrector now calculates an opposite (inverse) filter and processes hereby loaded sound files. This means that the result in frequency response and volume for both the right and the left ear can be perceived corrected, because the two filters (hearing impairment and **Hearing Corrector**) neutralize each other.

In this way music finds back to clarity and transparency, speech is more understandable.

In practice, however, there are certain limitations. For example, if there is is a hearing loss of 50 dB at the frequency 5 kHz, it may be that a correction of 50 dB, that is level increase to 50 dB at 5 kHz exceeds the headroom. Distortion would result. Therefore, and also to avoid hearing damage, **Hearing Corrector** limits the correction to a reasonable adjustable value.

Hearing Corrector detects imminent overloading and distortion that would result from the correction, and prevents this by a level decrease for the entire music, but without distorting the left-right balance. Therefore, it may be that the corrected results are indeed pleasant and sound intelligible, but compared to the original quiet down.

⚠ Attention, important note:
This relationship is important to understand because it means that there can be significant differences in volume between the original and correction as well when turning off the correction. This also applies to result files produced with **Hearing Corrector**, which can sound quieter than their originals, although individual frequencies are very loud. Therefore, when "jumping" between the original and the correction it is essential to check that the system volume is not too high. If this namely increased because of the quiet down sounding correction, the original music can be very loud in comparison.

Please aks necessarily a normal hearing person to check that your music is not set too loud.

Questions regarding this matter may be addressed to IND. Damages for listening fatigue or hearing impairment are excluded in any case.

Hearing Corrector can be used as corrective Music Player (preview) and to calculate corrected sound files that are exported. These sound files can be transferred in the music library or on the phone to have corrected music always at one's fingertips.

In addition to the correction based on the audiogram **Hearing Corrector** also includes a 16-band equalizer for further modification of the music according to taste.

The following sections explain the individual controls in detail, but first the system requirements.

2   System requirements, installation and deinstallation

Currently **Hearing Corrector** is only available for Mac systems. The minimum system requirements are:

- Operating System: Mac OS 10.9 Mavericks or higher
- Internet browser to display help files
- Main memory: 512 MB
- Hard disk space: 20 MB
- Processor clock: 2 GHz

MAC licenses are sold through Apple's iTunes platform. Installation and uninstallation done through Apple's standard procedures.

After installation, a program is usually "programs" stored in the folder. Double click the "HearingCorrector.app" file to start the program.

3 The Hearing Corrector progam window

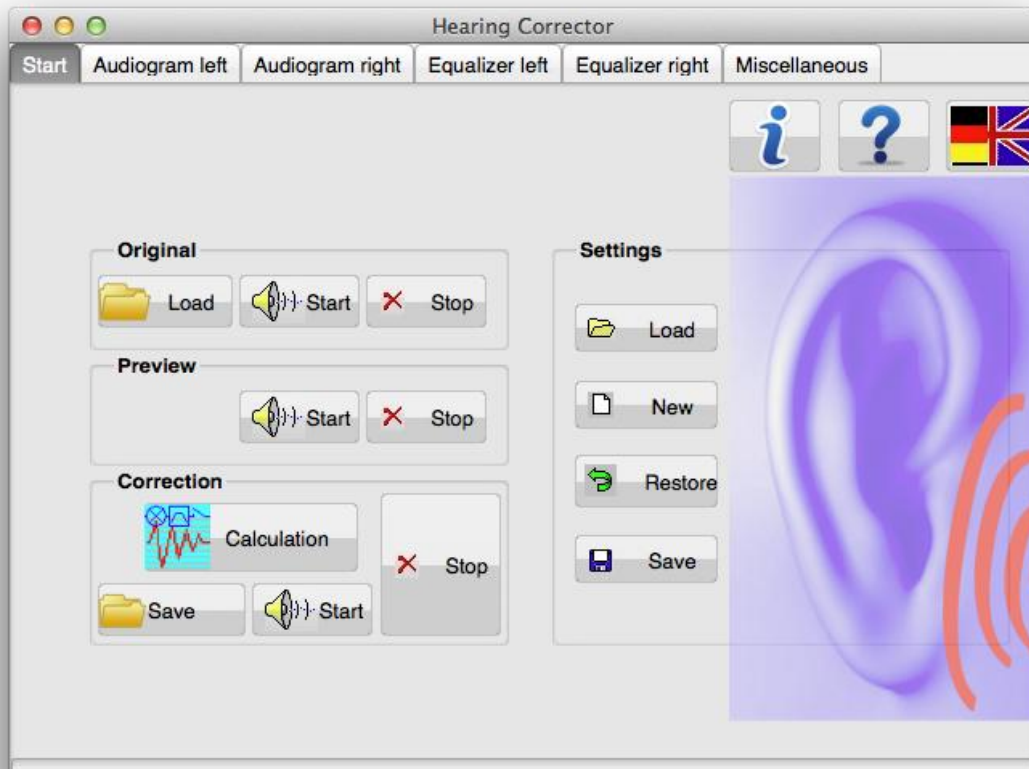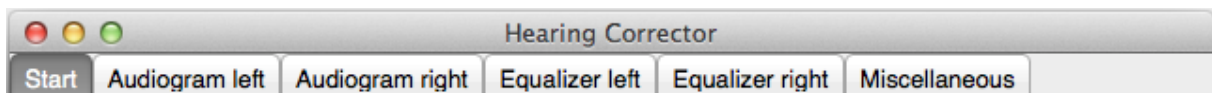When starting the program the following program window is shown:

Figure 3-1: The Hearing Corrector programm window after program start

The program is structured in so-called Tabulators. The individual pages are accessible via the tabs at the top of the window:

They are:

- Start
- Audiogram left
- Audiogram right
- Equalizer left
- Equalizer right
- Miscellaneous

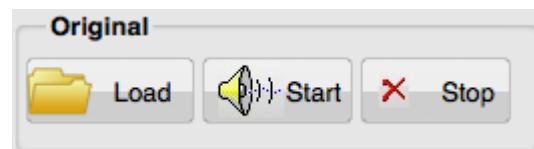At the bottom, a progress bar is shown, which allows to estimate the remaining time for some functions.

The controls for the individual pages are now explained.

3.1 Start

The start page is divided into 5 groups of switches:

Original
Preview
Correction
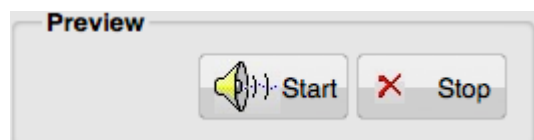Setttings
Info, Help, Language

3.1.1 Original

Use the "Load" button to select a sound file that shall be opened. Supported file formats are

- WAV, 16 Bit
- WAV, 24 Bit
- WAV, 32 Bit
- WAV, 32 Bit-Float

each in Mono or Stereo with any sampling rate.

Via the "Start" button, the original file is played back immediately and finished on the "Stop" button to start playback.

3.1.2 Preview

The preview group allows the immediate calculation of the correction and sound playback ("Start") and the termination of the playback ("Stop"). During playback, changes of the sound settings are possible and can be tested immediately.

_____

Hint:
The Preview function is only available for Music with the CD typical sampling rate 44100 Hz. Music with other sampling rates can be corrected in bulk with the function "Correction" and played back, see next section.

3.1.3 Correction
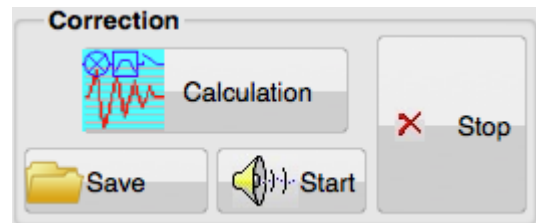
The final calculation of the corrected result file is done in this section. The button "calculate" starts the correction calculation, "Stop" breaks it off. Via "Save" the result is eg written to disk with a freely selectable file name. The file format is identical to the original file.
Via the "Start" button, the result file will be played back and stopped via the "Stop" button. If a current calculation does not exist the functions "Save" and "Start" include the previous calculation.

3.1.4 Setttings
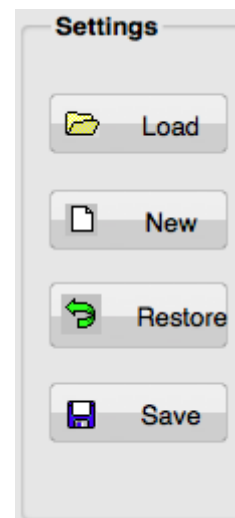
Hearing Corrector remembers all settings from one session to the next. This section is used to load and save different settings. The "Load" button loads a previously saved file. "New" brings all the settings in a neutral position. The button "Restore" makes previous sound settings reversed. "Save" enables you to store a setting to load later.

3.1.5 Info, Help, Language

The "i" button gives program information and provides a link to the manufacturers page. "?" shows this manual. And the flags button toggles the program between national languages German and English.

3.2 Audiogram left

The audiogram shows the hearing separately for left and right ear according to DIN EN ISO 8253 and is created eg by ENT doctor a hearing test. The audiogram shows the hearing threshold for different frequencies.

The audiogram filter serves to correct the hearing defect on the basis of individual audiograms for the left and right ear.

Example:

In most cases, there is a hearing loss in a high range. This means that high-pitched sounds are perceived more weak and quieter. In this case, a volume increase of the higher frequencies will cause a tone correction.

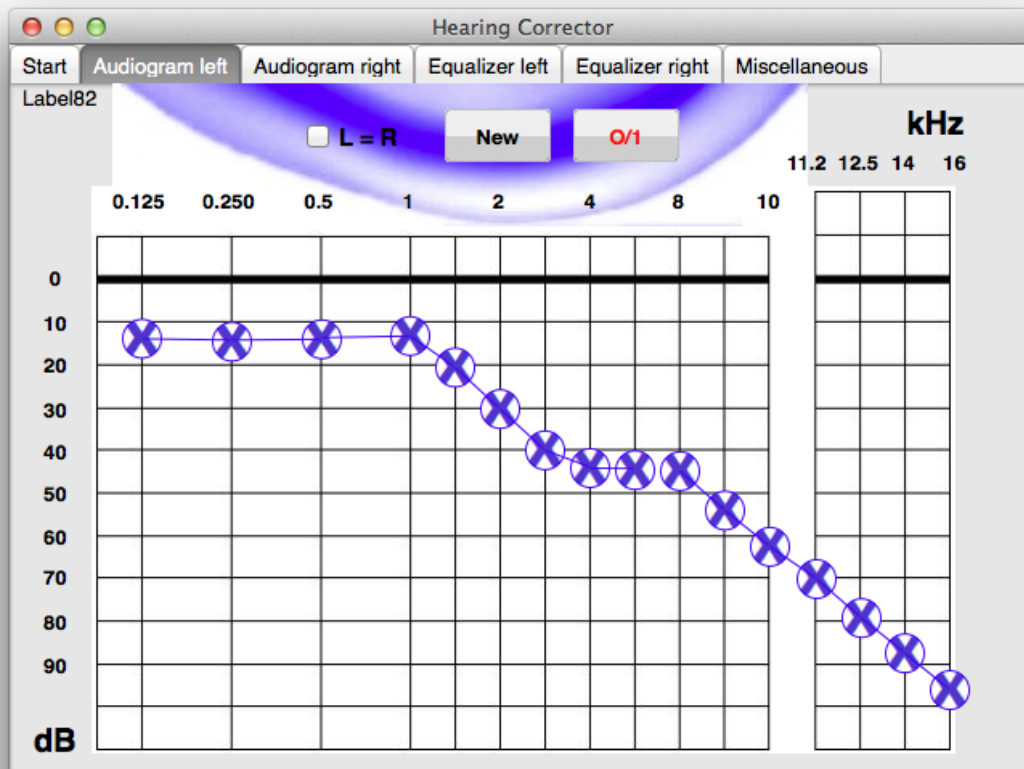Corrections are not always possible, for example, if there are serious hearing damages.

Figure 3-2: Audiogramm setting left ear

In this window the audiogram for the left ear is set. If not all frequencies have been detected in the listening test, you can center the interim values.
Downward movement of an adjuster (= hearing loss) causes an amplifying of the respective frequency.

The check box **L = R** is selected, if both ears have the same hearing impairment. Left and right sides are then linked and must not be set twice.

The button **New** moves all controls to their neutral position.

The button **O/1** turns on the audiogram filter on and off. The lettering is red when switched on, otherwise black.

⚠️ **Attention, important note:**
When you turn off the audiogram filter the correction is disabled. This means possibly that level reductions that are necessary for the correction are no longer active. To ensure that this does not happen abruptly, the gain reduction is retracted slowly.

_____

Nevertheless, at the end the sound will be louder than before switching the correction off.

When the correction is switched on those frequencies are amplified, which are perceived weaker. If the corrected signal would exceed the headroom the entire signal and both channels are attenuated in order to maintain the desired ratio.

3.3 Audiogram right

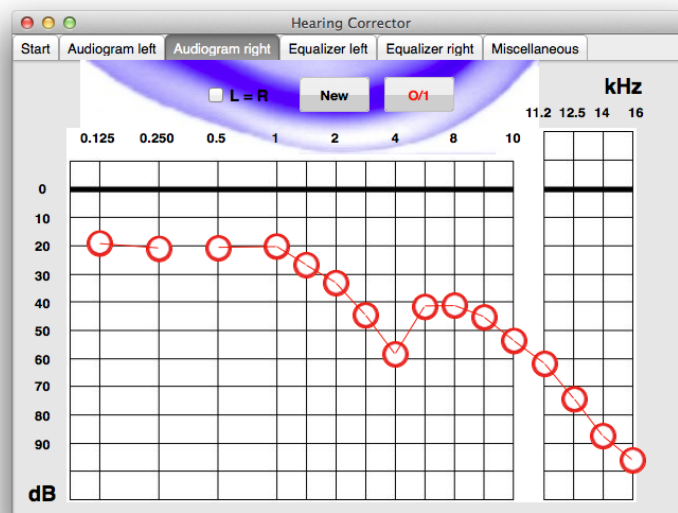This audiogram window for the right ear is the same as the window for the left ear.

Figure 3-3: Audiogramm setting right ear

3.4 Equalizer left

Hearing Corrector has got one 16-band equalizer for each ears. The following figure shows the equalizer for the left side:
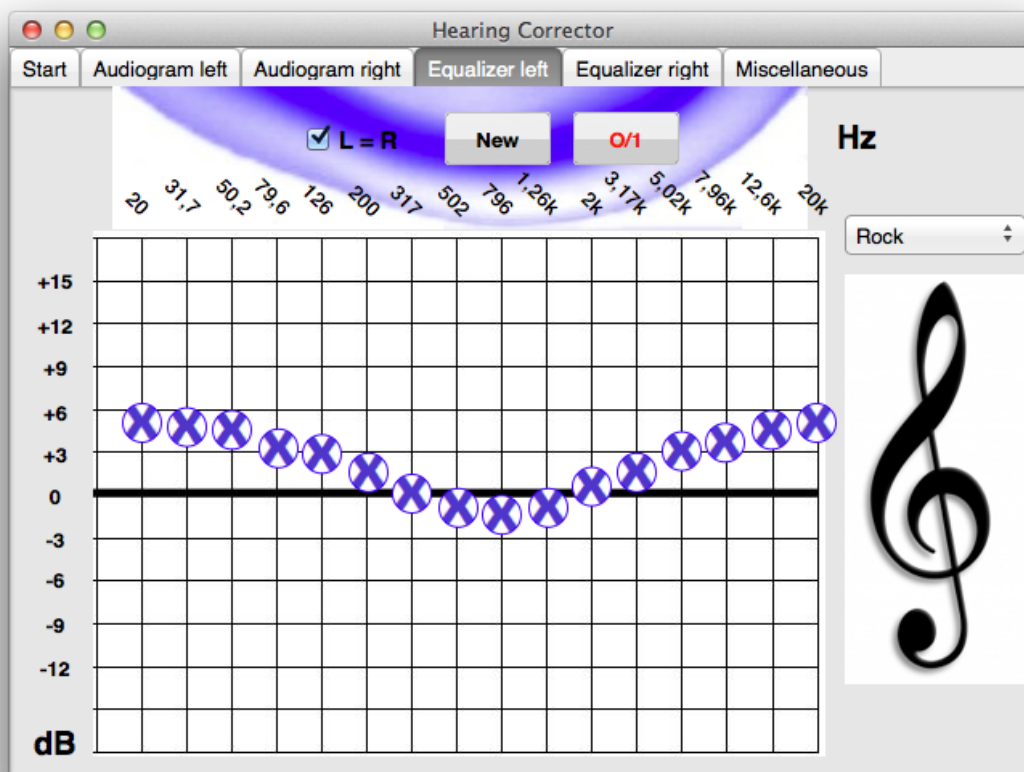
Figure 3-4: Equalizer left ear

The movement of an adjuster in the positive dB region causes an amplification of the respective frequency. Moving it below the 0 dB line results in an attenuation.

The check box [ ] **L = R** is selected, if both ears have the same hearing impairment. Left and right sides are then linked and must not be set twice.

The button **New** moves all controls to their neutral position.

The button **O/1** switches the equalizer filter on and off. The lettering is red when switched on, otherwise black.

The select list **Presets:** contains some standard presets for equalizer.

3.5 Equalizer right

This equalizer window for the right ear is the same as the window for the left ear:
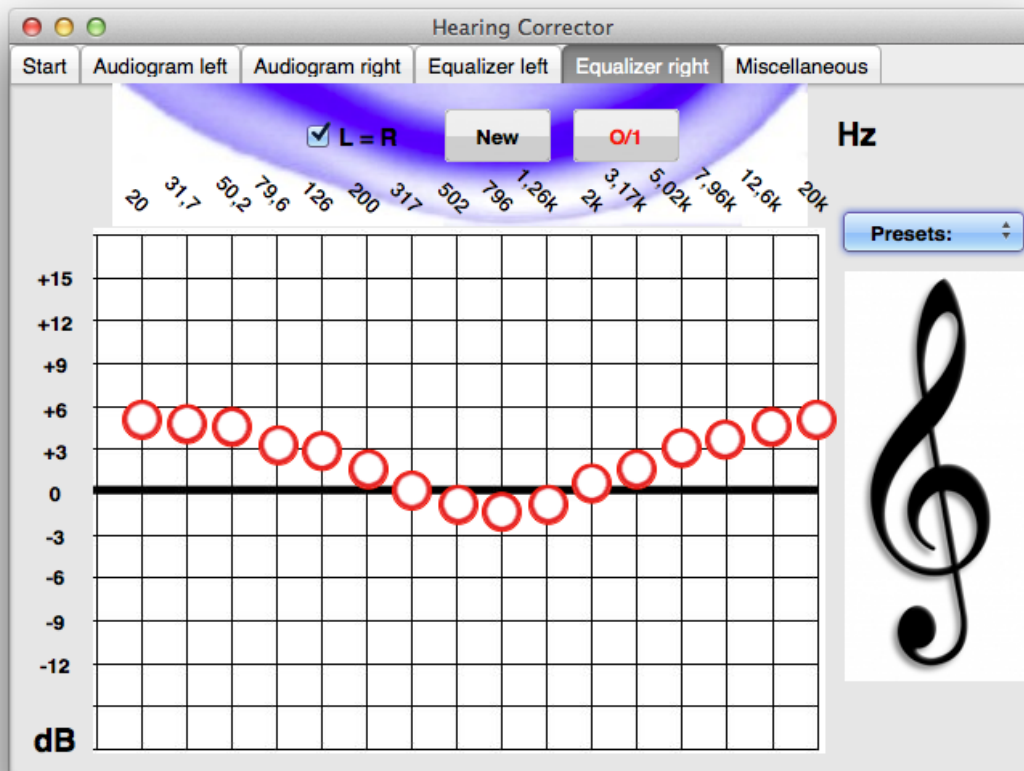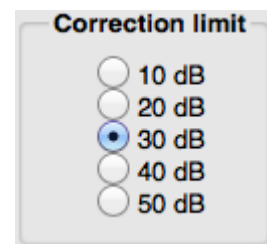
Figure 3-5: Equalizer right ear

3.6 Miscellaneous

In version 1.1 there are in the "Miscellaneous" window only one setting: the "Correction limit". This is a value in dB, which limits the maximum frequency response correction. This means that for example even if the audiogram shows a hearing defect of 60 dB at a certain frequency **Hearing Corrector** will perform the correction only to the limit selected here.

4 Table of figures

- This page is intentionally left blank -