

MEDRXINC  
*OtoWizard*<sup>™</sup>

**SOFTWARE  
TRAINING MANUAL**

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## INTRODUCTION

### **Congratulations!**

You have greatly enhanced your professional profile and ability to provide quality-hearing health care by incorporating the MedRx OtoWizard™ in your daily practice.

The OtoWizard™ is the first fitting system to integrate all the essential instrumentation for hearing evaluation and hearing aid fitting. It is designed for easy use and provides excellent counseling tools to interact with the patient and third parties.

You are ready to use the OtoWizard™ Training Manual after you have setup and installed the OtoWizard in accordance with the installation documentation provided with your system.

#### HOW TO USE THE TRAINING MANUAL

To become proficient at using the OtoWizard™, you must invest some time in learning the software. You will be greatly rewarded when you do so. The OtoWizard™ Training Manual is separated into Lessons for each of the main functions of the software. Each Lesson contains Exercises to take you step-by-step through the software.

Each time you see underlined text, you are required to perform an action, such as inserting the probe tube in the patient's ear canal.

Text in *italics* denotes an icon in the software. The corresponding graphic is presented in the left margin to help you identify the icon to click on.

The first Lesson, "Getting Started" describes the basic operation of the software. It is recommended you complete the Lessons in the order in which they are presented in the Manual. Repeat a Lesson for more practice and to refresh your performance when required.

Once again, Congratulations on your purchase of the MedRx OtoWizard™.

#### CHEERS TO YOUR SUCCESS!

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## LESSON ONE

### Getting Started

The MedRx OtoWizard software runs in a Windows 95 or higher operating system. It is assumed you are familiar with operating a mouse and keyboard in Windows. Unless otherwise stated, always use a single left mouse click to select an icon in the OtoWizard software. You will find extensive help for all software functions in the Help files. To access Help, click the question mark Help icon on the screen or click Help on the toolbar or press F1 on the keyboard.

It is assumed you have a working knowledge of hearing health care and hearing aid dispensing. You must know how to perform an audiometric assessment and have a basic understanding of hearing instrument fitting supported by real ear measurements.

#### About the software

The software installed on your OtoWizard is unique to your system. Each system has a unique serial number, which prevents duplication of your OtoWizard software to another system.

#### SERIAL NUMBER

To find out the serial number of your system, go to the toolbar on the main menu screen and click **Help | About OtoWizard**.

#### SOFTWARE VERSION NUMBER

Read the version number on the **Help | About OtoWizard** window.



ACCOUNT AND PASSWORD

You will need to setup your account and password the first time the OtoWizard software is run on your system. The account and password allow the database to record the user's name with each patient they see.

Each individual user needs to have an account and password. To add a new user, go to the toolbar on the OtoWizard main menu screen and click **Account | New**.

LOGIN

Each time a user starts the OtoWizard program from the desktop, the user is required to enter their password to login to the database. While there is no way to disable the database password, you can automate the login procedure.

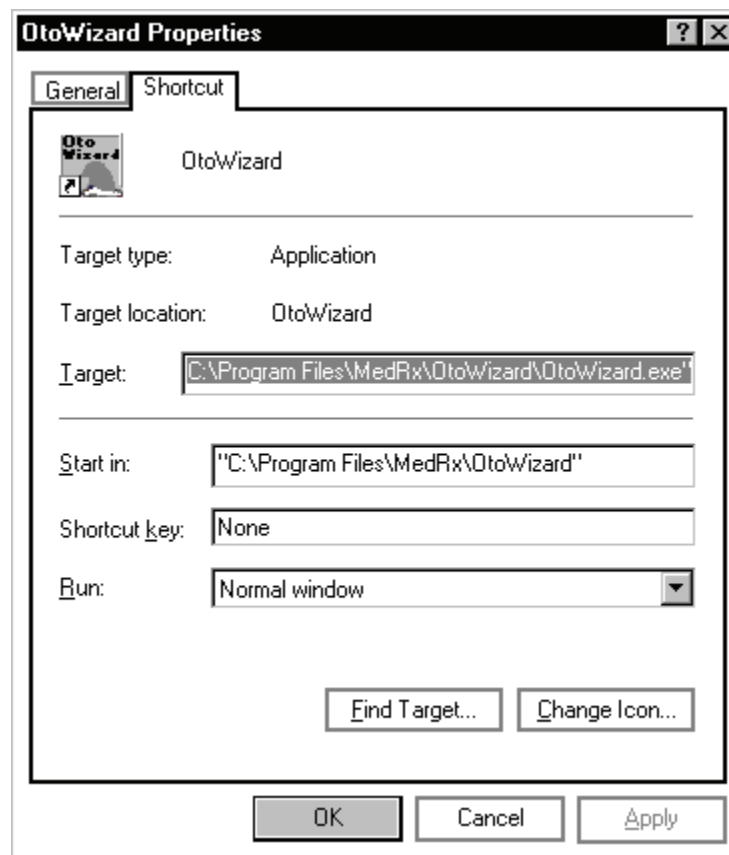
Click the right mouse button on the *OtoWizard* program icon on the desktop.

Click **Properties**.

On the line next to Target, there is a line of text that describes the location of the OtoWizard program on the system. At the end of the line are the letters ".exe". Point and click the mouse to the space after ".exe" and a flashing cursor appears.

Type a space followed by your password. Example:OtoWizard.exe hearman





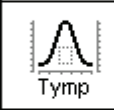

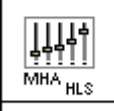

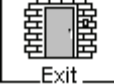
Click *OK* to accept the changes.



The next time you start the OtoWizard from the desktop, you will not need to enter your password.

OTOWIZARD SOFTWARE MENU

The main menu screen gives you access to the following functions:

Patient Database	 Patient
Preview Video Otoscopy	 Preview
Audiometry	 Audio
Real Ear Measurements	 REM
Tympanometry	 Tymp
Loudness Scaling	 LS
Master Hearing Aid   Hearing Loss Simulator	 MHA HLS
Hearing Instrument Test	 H.I.Test
Exit	 Exit



BASIC SCREEN DESCRIPTION

To keep the software easy to operate, the layout of the display is consistent throughout the program. The following diagram and text describes this common format. Please read the following paragraph. Do not click on any icons until indicated with *italics*. Try to locate features as they are described.

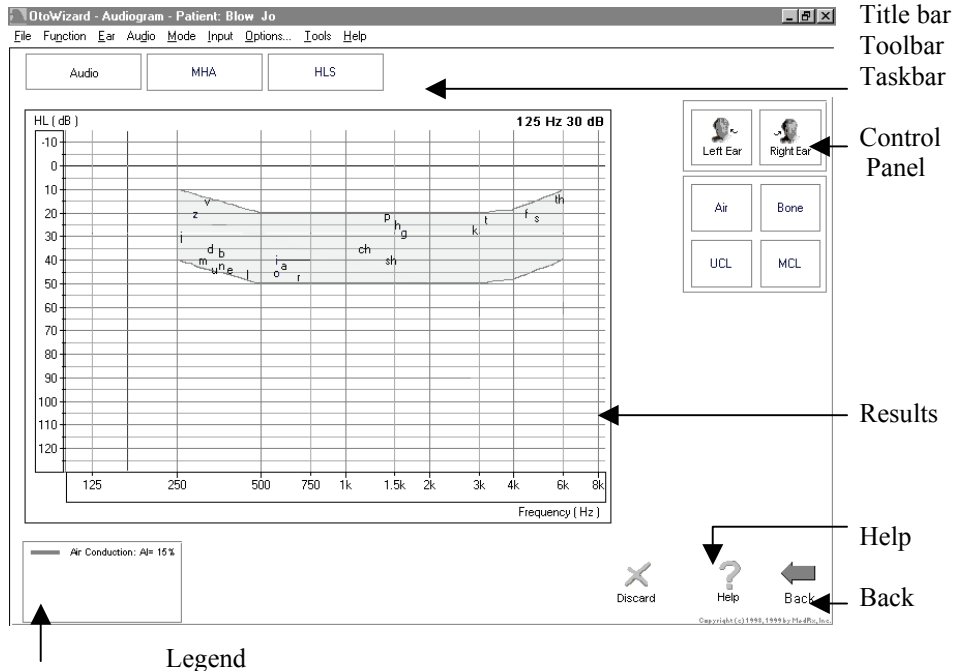
The title bar at the top of the screen states the function you are performing. If you have a patient folder open, the patient's name will also be on the title bar. For all measurement functions, the results are displayed on a large central grid. The control panel for selecting the test ear, signal inputs and transducers is always located on the right side of the display. A Legend is positioned in the lower left corner of the display and provides a color-coded key to interpret the results on the display. Access Help from the Help icon in the lower right corner. To return to the previous screen, use the Back icon in the lower right corner.

(Now is the time for you to start to click your mouse!)

Click *MHA / HLS* on the main menu.

Identify each basic feature of the display format as outlined above. You should see the following diagram on your screen.

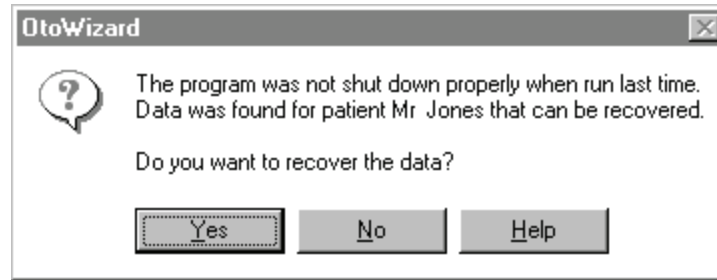
MHA | HLS display



SAVING DATA

Results are automatically stored to the database when you close a patient's folder.

In case of abnormal termination of the OtoWizard program, there is an automatic recovery algorithm that will give you the opportunity to recover data in the current patient's record the next time the OtoWizard program is started. Look for this option to save data when you restart your system.

EXITING THE OTOWIZARD

ALWAYS use the Exit icon on the main menu screen to close the OtoWizard program. When you close the program, you are reminded to backup the database. It is recommended you backup the database frequently to avoid losing data in case of system failure.

DATABASE BACKUP AND RESTORE

When you want to backup or restore the database, go to the main menu screen toolbar, and select **Tools | Database | Backup**. Select the destination to backup the database file to and click *Start*. The type of backup you have chosen for your office determines the backup destination. Call technical support if you need additional assistance with a backup device.

To Restore the database after abnormal system shutdown, go to the main menu screen toolbar and select **Tools | Database | Restore**. The prompt tells you the program will log off then on again to initiate the recovery program.

CALIBRATION

The OtoWizard is calibrated to meet the requirements of the current ANSI standard for Audiometers. It is equipped with calibrated microphones, insert earphones and bone conductor. Most states require annual calibration of audiometric equipment. System calibration is also required whenever the coupler microphone is replaced.

The OtoWizard calibration utility is accessed from the main menu toolbar. The calibration options are: Probe Microphone; Microphones; Headphones; System and Backup Calibration. The only procedure you need to perform on a regular basis is the Probe Tube calibration. The only other calibration procedures you would perform in your office would be for the box reference microphone or free field reference microphone. All other calibration procedures must be performed by a licensed calibration technician or by MedRx technical support. When you see the following prompt on startup of the OtoWizard software, it is time to send your insert earphones to MedRx for calibration.



***Probe Tube Calibration:***

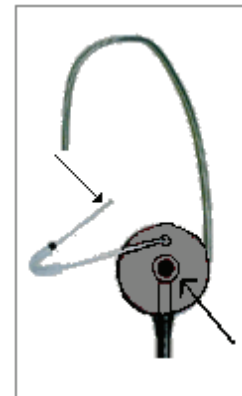
**CALIBRATE THE PROBE TUBE EACH TIME A NEW TUBE IS USED.  
IT IS RECOMMENDED YOU USE A NEW TUBE FOR EACH PATIENT.**

From the main menu toolbar, select **Calibrate | Probe Tube**.

Follow the instructions to position the tip of the silicon tube against the free field microphone of the probe microphone assembly. Slide the elbow half way along the tube to help hold it in this position. While holding the probe tube assembly from the top of the earhook, hold the assembly 6 -12 inches from the box loudspeaker at an angle of 90 degrees (duplicating the natural position of the probe microphone assembly as it sits on a patient's ear during testing).

Probe microphone assembly:

The arrows indicate the tip of the probe tube and the free field reference microphone. The tip of the tube needs to rest against the free field reference microphone for calibration of the probe tube.



Click *Start*.

The system automatically calibrates the new probe tube. The new curve should closely resemble the stored curve on the screen. If it is significantly different, inspect the probe tube for defects, replace the tube with a new one if necessary and repeat the test.

## LESSON TWO

### Patient Database and Storing Video Otoscope and Portrait Images

Required reading:

Press F1 from the main menu screen and read the Patient Database topic. Read the blue links to other patient database topics. Close the Help file using the X icon.

The database is made up of a folder for each patient. Within each patient's folder, a new record is created and stored for each appointment.

The exercises in this lesson teach you to create a Patient folder, create a New Record in the patient's folder and store images in the database.

Note: There are two ways of operating the OtoWizard software. The first is as a stand-alone program and the second is to run the OtoWizard from within NOAH, in which case, NOAH is the database. It is useful to know how the OtoWizard operates as a stand-alone program, even if you intend on running the program from within NOAH. Exercises 1,2 and 3 in this lesson teach you how to run the OtoWizard database. Exercise 4 teaches you how to store images to either the OtoWizard or NOAH database.

### EXERCISES

#### EXERCISE ONE: CREATE A PATIENT FOLDER

#### EXERCISE TWO: STORE PORTRAIT IMAGES TO THE PATIENT'S FOLDER

#### EXERCISE THREE: CREATE A NEW RECORD INSIDE THE PATIENT'S FOLDER

#### EXERCISE FOUR: STORE VIDEO OTOSCOPIC IMAGES TO THE PATIENT RECORD

#### EXERCISE ONE: CREATE A PATIENT FOLDER



Patient

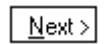
Click the *Patient* icon on the OtoWizard main menu screen.



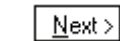
New

Click *New*.

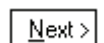
Enter at least the Patient's First and Last names. The required fields for data entry are indicated by an \* symbol.



Click *Next*. Enter contact information.



Click *Next*. Complete the basic patient Questionnaire. The default response is NO. Only check a box if the response is YES.



Click *Next*



Click *Finish*.

You have finished creating a folder for the new patient. The folder contains only basic personal identification details at this stage. You should now see the Patient's name on the blue title bar at the top of the screen.

**EXERCISE TWO: STORE PORTRAIT IMAGES TO THE PATIENT'S FOLDER**

Portrait

Continuing with the Patient folder created above, click the *Portrait* icon.



Frame

Click *Frame*. This activates the camera.

You should see a full screen image. Adjust the focus and aperture rings on the camera to provide a good image on the screen.



Frame

Click *Frame* to capture the image.

The captured image appears on the left of the screen. The date stamp attached to the image appears on the right of the screen.

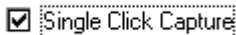
Capture as many portrait images as you like by repeating these last two steps. Each portrait image is date stamped. Comments can be attached to each image by typing in the Image Comments box at the bottom of the display.

**EASY KEYBOARD METHOD FOR CAPTURING AN IMAGE ON THE SCREEN:**

Frame

Use the single click capture mode to capture the portrait image.

Click *Frame*.



Click in the white box beside the words *Single Click Capture* on the taskbar.



Frame

Click *Frame*. All the screen icons are now inactive.

Hit any key on the keyboard to capture the desired image. It is sometimes convenient to have the patient hit the keyboard for you, at your prompting.

Capture as many portrait images as you like by repeating these three steps. Each portrait image is date stamped. Comments can be attached to each image by typing in the Image Comments box at the bottom of the display.



Back

When you have finished taking portrait images, click the *Back* icon to return to the patient record menu.

At this point, you would normally create a New Record for today's appointment and proceed with testing. For the purposes of this lesson, we will continue with the exercises to explore the database further.

**Further options:**

OPENING STORED PORTRAIT IMAGES

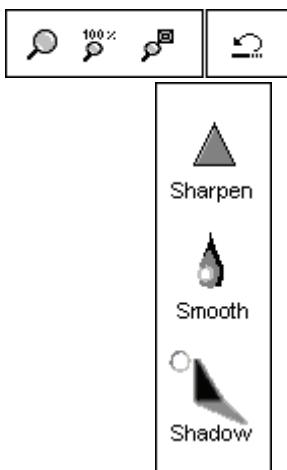
Open a stored image and use the enhancement tools

Click *Portrait*.

Click the image to be viewed in the date column. The date is now highlighted in blue.



Click *Open*.



When an image is opened, you can use any of the editing tools to enhance the image for better viewing. These tools include, *zoom*, *sharpen*, *smooth* and *shadow*. Each successive adjustment to the image can be deleted by using the undo icon on the toolbar.

Enhancements made to the image on this screen have no effect on the initial stored image. The original image remains in the database unchanged.

Practice using these tools. Click on each of the editing icons. *Sharpen*, *Smooth* and *Shadow*.

Undo all changes by clicking on the *undo* icon until the original image is restored.

DELETE A PORTRAIT



You can delete any unwanted image by clicking on the desired image listed under the date column and clicking on *Delete*.

PRINT A PORTRAIT

Click the portrait to be printed from the list in the date column. The date should be highlighted blue.

Go to File on the toolbar and click Page Setup. **File | Page Setup.**



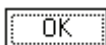
Check the box next to *Portraits*.



Click *OK*.

Make sure the printer has been installed and is turned on.

Go to File on the toolbar and click Print. **File | Print.**



Customize Properties as needed and click *OK*.

EXIT THE PORTRAIT IMAGE TASK



When you have finished taking portrait images, click the *Back* icon to return to the patient record options.

**EXERCISE THREE: CREATE A NEW RECORD INSIDE THE PATIENT FOLDER**

To continue adding data to this patient's record, you must create a New Record for this appointment. A New Record is created at each appointment with the patient.



Click *New Record*.

A Record Questionnaire of nine standard questions appears. These questions appear for every New Record as the patient's response to some of these questions can change over time. The default response is NO to each question. Only check the white box next to any question where the response is YES.

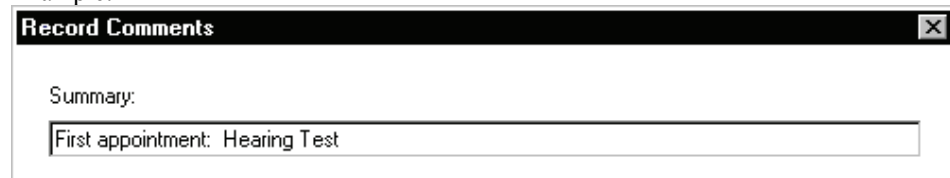
Add notes to the Comments section to record additional details as required.



When the questions and comments are complete, click *Next*.

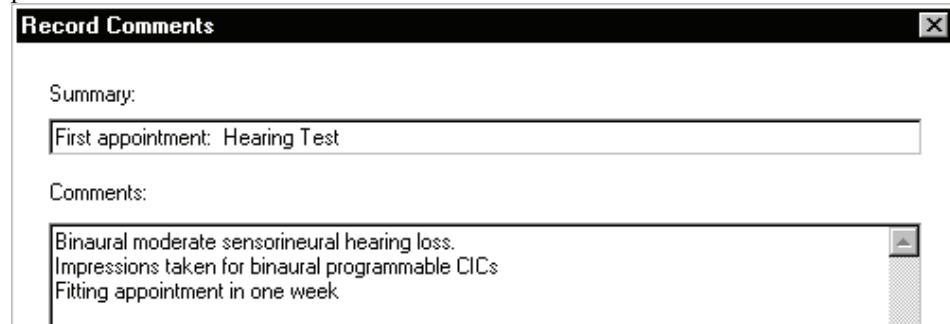
Always enter a brief description of the day's appointment in the Summary field. This will help you search for specific records within the patient's folder at a future date.

Example:



Leave the Comments field blank at the moment. This section is for use when the record is closed to summarize the outcome of the day's appointment.

Example: These comments were added at the end of the appointment when the patient's folder was closed.





Click *Next* and then *Finish*.



Congratulations! You have just generated the "paper " on which to record today's information.

You have two options from this point. The first option is to go to the main menu screen by selecting the Use Record icon. Do not do this yet. The second option is to store video otoscopic images to the patient record. Proceed to Exercise Four to learn how to store video otoscope images to the patient record.

#### **EXERCISE FOUR: STORE VIDEO OTOSCOPIC IMAGES TO THE PATIENT RECORD.**



Click *Open Images*.



Frame

Click *Frame*. This activates the video otoscope camera. You should see a full screen video otoscope image.

The default labels for the video otoscopic images are Left Ear, Right Ear, Portrait, Left Hearing Aid and Right Hearing Aid. Select the appropriate label for the image to be taken by clicking on the desired label from the pull down list on the task bar. You can customize a label by first clicking in the label box and typing the desired label into the text box.

Place the video otoscope probe to obtain the desired image on the display.



Frame

Click *Frame* to capture the image.

The captured image appears on the left of the screen. The label attached to the image appears in the Description column on the right of the screen.

#### **Add Comments**

Comments can be attached to each image by typing in the Comments box at the bottom of the display. First, click the image description to highlight the label. Click in the Comments field. You will see a black flashing cursor in the comments box. Type the required comments for the image.

Capture as many images as you like by repeating these steps.

#### **SINGLE CLICK CAPTURE METHOD FOR CAPTURING IMAGES**

Use the single click capture mode to capture the image.



Click in the white box beside the words *Single Click Capture* on the taskbar.



Frame

Click *Frame*. All the screen icons are now inactive.

Place the video otoscope probe to obtain the desired image on the display.



Hit any key on the keyboard to capture the desired image. It is sometimes convenient to have the patient hit the keyboard for you.

The captured image appears on the left of the display. The image label and date appears under the Description column on the right.

To continue adding images to the record, click the *Frame* icon and repeat the steps above. OR If you wish to take multiple images under the same label, check the box next to *Sequence*, and continue to press any key on the keyboard to take a sequence of images.

### What can I do with the stored images?

#### ENHANCE OR EDIT AN IMAGE



Click to highlight the label in the description column for the image you want to open. Click *Open*.



When an image is opened, you can use any of the editing tools to enhance the image for better viewing. These tools include, *zoom*, *sharpen*, *smooth* and *shadow*. Each successive adjustment to the image can be deleted by using the undo icon on the toolbar.



Enhancements made to the image on this screen have no effect on the initial stored image. The original image remains in the database unchanged.

Practice using these tools. Click on each of the editing icons. *Sharpen*, *Smooth* and *Shadow*.

Undo all changes by clicking on the *undo* icon until the original image is restored.

#### DELETE AN IMAGE

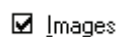


You can delete any unwanted image by clicking on the label for the image to be removed and clicking on *Delete*.

#### PRINT AN IMAGE

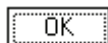
Click the label for the image to be printed from the list in the description column. The label should be highlighted blue.

Go to File on the toolbar and click Print Setup. **File | Page Setup.**



Check the box next to Images in the Print box.

If you want to print all images, you can customize the layout in the Columns box.



Click *OK*.

Make sure the printer has been installed and is turned on.

Go to File on the toolbar and click Print. **File | Print**. To preview the printout, select **Print Preview** first.



Customize printer **Properties** as needed and click *OK*.

#### RENAME AN IMAGE

If you want to give a stored image a different label, point the mouse to the label, in the Description column, to be changed and right click the mouse button. Select *Rename* and type the new label for the image.

#### EXIT THE IMAGE STORING TASK



When you have finished taking images, click the *Back* icon to return to the patient record options

#### Prepare for the next Lesson



To continue working with the current patient record, click the *Use Record* icon. You will now see the OtoWizard main menu screen with the current patient's name on the title bar at the top of the screen. You can proceed to any main menu function from this screen.

## LESSON THREE

### AUDIOMETRY

This lesson shows you how to perform pure tone audiometry using the OtoWizard.

#### EXERCISES

##### EXERCISE ONE: SETTING UP THE AUDIOMETER SOFTWARE

##### EXERCISE TWO: HOW TO PERFORM AUDIOMETRY

##### EXERCISE THREE: OBTAINING DISCRETE FREQUENCY UCLS

##### EXERCISE FOUR: REMOVING UNWANTED DATA FROM THE AUDIOGRAM

##### EXERCISE FIVE: CUSTOMIZING AUDIOMETRY

#### Preparing for Exercise One

There are two ways of operating the OtoWizard software. The first is as a stand-alone program from the desktop. The second is to run the OtoWizard from within NOAH after you have installed the OtoWizard measurement module in NOAH.

Select from the two approaches described below to open a patient's folder.

#### **Open a Patient Folder**

##### OtoWizard stand-alone program from the desktop:



Click the *OtoWizard* icon on the desktop to start the program.



Click *Patient*. Click on a patient's name from the list in your database.



Click *Open*.



Click *New Record*. Enter details as appropriate until a new record for today's appointment is created.



Click *Use Record*. The main menu for the OtoWizard is now on your screen.

#### **OR**

##### Running the OtoWizard from within NOAH:



Lesson Eight provides exercises in how to setup and operate the OtoWizard from within NOAH.

Open *NOAH* from the desktop.

Open the patient's folder (Client).



Click the measurement module ( $\Omega$ ) icon on the toolbar. The OtoWizard main menu appears on your screen.

**EXERCISE ONE: SETTING UP THE AUDIOMETER SOFTWARE**



Click *Audio* from the main menu screen to enter Audiometry. The hourglass icon appears on the screen while the system checks for the presence of all the appropriate hardware for Audiometry.

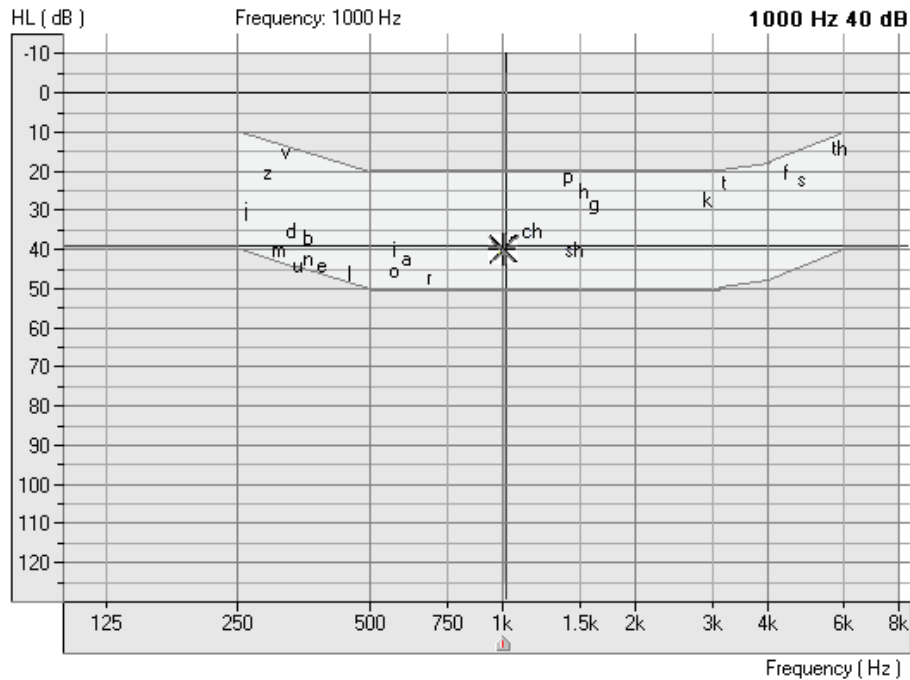


Click *Help*. Read the Tone Audiometry help topic and follow the link to Audiometry Control Panel icons.

Close the Help screen by clicking the *X* icon at the top right corner of the screen.

Understanding the Audiometry display:

The yellow asterisk symbol on the audiogram lets you know the test level and frequency the audiometer is currently set to. This information is also obtained by noting the Test dB attenuator level on the control panel and the arrow icon below the audiogram indicates the test frequency.



Audiogram

The speaker icon, located under the attenuator control bars, lets you know when a tone is on or off.



The Audiometry control panel is designed for one icon to be selected in each row. The default settings are: Right Ear, Air Conduction, Tone, Continuous and AUD. If you prefer to start testing with a different setup, simply click on the desired icon on the control panel.



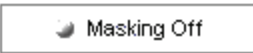
For example: To change from Air Conduction (AC) to Bone Conduction (BC), click the *BC* icon.



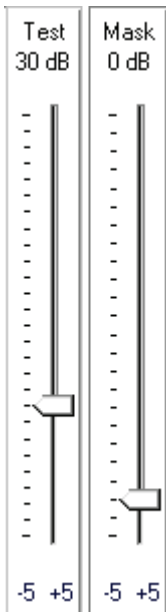
To change from threshold testing to either discrete frequency MCL or UCL testing, click on the *MCL* or *UCL* icon respectively.



The *Masking OFF/ON* icon toggles between OFF and ON with each click on the Masking icon. The icon text indicates the current status. If the icon says Masking On, then masking noise is ON. To turn it off, click on the Masking icon and it will change to Masking OFF.



To set the Test Level:



There are a few methods to control the test level attenuator in Audiometry. Some methods use the mouse only, while others use the keyboard. A special Audiometer keyboard, with attenuator knobs, is also an available option.

Practice each option below and find the one you prefer.

Option One

Point the mouse to the *arrow* icon on the Test dB attenuator bar. Click and hold down the left mouse button on the arrow icon and drag it to the desired test level and release the mouse button.

Option Two

Click the -5 or +5 icon to change the attenuator in 5dB steps in the corresponding direction.

Option Three

Click anywhere on the *Test dB* attenuator bar to get a dashed box around the bar. This has activated the keyboard controls of the attenuator. Press the up or down arrow key on the keyboard to step the attenuator up or down. The default step size is up 5dB and down 10dB. The screen attenuator and asterisk symbol on the audiogram are automatically updated each time the arrow keys are pressed.

Option Four



Click on the *Up arrow* or *Down arrow* icons below the Test dB attenuator. Each click steps the attenuator in the appropriate corresponding arrow direction. The default step sizes are up 5dB and down 10dB.

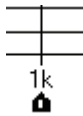
Note: The default step size for the arrow icons and keyboard arrow keys can be customized under **Options | Audiometry**. (See Exercise Five)

Option Five

Using the special Audiometer keyboard, simply turn the right attenuator dial in a clockwise direction to increase the test level, and anti-clockwise to decrease the test level.

To set the test Frequency:

Option One



Press the Left or Right arrow key on the keyboard to step the desired test frequency. The arrow icon under the Audiogram indicates the current test frequency. The yellow asterisk on the Audiogram will also track to the new frequency selected.

Option Two

Point the mouse to the desired test frequency script under the Audiogram and click on that frequency. The *arrow* icon will snap to this new frequency.

Practice this option: Point and click the mouse to the text *2k* under the audiogram. The arrow icon will snap to 2k.

Patient Response



If the patient is using the handswitch, the green patient response icon will highlight on the display when the button on the handswitch is pressed.

No Response



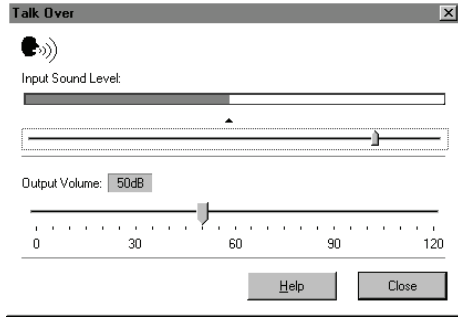
To indicate a patient did not respond to the maximum output of the audiometer for that frequency, click *No Response*. The appropriate No Response symbol is recorded on the audiogram.

How to use Talkover



Click *Talkover*.

Position your talkover microphone. The microphone needs to be close to your mouth and maintained at a constant distance from your mouth while in use.

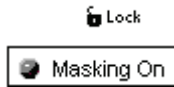


Speak at a normal level and calibrate the Input Sound Level to the microphone by sliding the *arrow* icon until the blue line on the VU meter just meets the calibration marker. When you see the VU meter line go past this marker, the line will be red. In this case, you have adjusted it too high.

The output to the patient can now be set to the desired decibel level using the Output Volume control. Click and hold the mouse button on the *arrow* icon and drag it to the volume needed for the patient to hear you through the insert earphones. Click *Close* to turn the talkover microphone off.

LOCK MASKING LEVEL TO THE TEST LEVEL

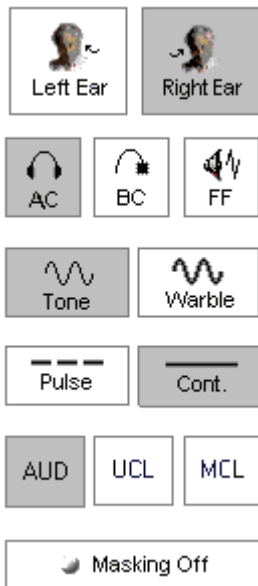
When masking, it is sometimes useful to determine a minimum masking level for a test level and then “lock” the masking attenuator to change with the test level. To do this, first set the attenuator to the test level and then determine the minimum effective masking level needed in the non-test ear and set the mask attenuator to this level. Now click the *Lock* icon and *Masking On*. All you have to do now is adjust the test level attenuator to find the masked threshold. The masking level will automatically adjust to the new test level as you seek threshold.



EXERCISE TWO: HOW TO PERFORM AUDIOMETRY

Assumption: It is assumed you know how to perform audiometric testing for obtaining air and bone conduction thresholds using pure tones.

It is most useful to perform this exercise on someone from your office. Make sure the test environment is quiet and you have all the audiometric hardware connected to the OtoWizard. Refer to the installation manual if necessary.



AIR CONDUCTION AUDIOMETRY

Setup the control panel for pure tone audiometry: *Right Ear, AC, Tone, Continuous* and *AUD*.

Set the Test Level attenuator to 40dB.

Set the test frequency to 1000Hz.



Perform an Otoscope examination of the ear canals. Activate the video otoscope preview mode by clicking the *camera* icon on the taskbar. Inspect each ear canal in the live mode.



Back

Click *Back* to return to Audiometry.

Instruct the patient in the task and how to respond to the tones.

Place the insert earphones in the patient's ear canals, ensuring an adequate insertion depth.

Present the first tone using your preferred method of presentation.

Monitor the patient's response and adjust the attenuator accordingly. You will notice the right AC symbol (O) is automatically recorded to the audiogram.

Search for hearing threshold.

When threshold is found, move to 2000Hz and find threshold. Each time you move to a new test frequency, the threshold for the previous frequency is automatically stored to the audiogram.

Test 1000,2000,3000,4000,8000, 500 and 250Hz.



When all the thresholds are obtained for the test frequencies required for the first ear, click *Left Ear* and repeat the procedure for the left ear.

#### BONE CONDUCTION



Click *Bone Conduction*.

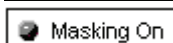
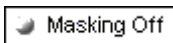
Place the bone conductor on the poorer air conduction threshold ear. Remove the insert earphones.

Practice finding BC thresholds for 1000, 2000, 4000 and 500Hz.

Use the same technique to find threshold as used in air conduction testing.

The appropriate bone conduction symbol is automatically plotted to the audiogram.

#### MASKING



When masking is required, click *Masking Off* to turn the masking narrow band noise on. The icon will now indicate Masking ON. Masking noise automatically routes to the non-test ear. Therefore, if you are testing right bone conduction and you select Masking, the masking noise automatically routes to the left insert earphone. Remember to place the air conduction insert earphone in the non-test ear for masking.





Set the masking level by adjusting the Mask level attenuator.

Turn masking off by clicking the Masking *On* icon. The icon will now say Masking OFF.

### **EXERCISE THREE: OBTAINING DISCRETE FREQUENCY UCLS**



To record discrete frequency UCLs, select *AC*, *Tone*, *Continuous* and *UCL* on the control panel.

Carefully instruct the patient in the task. The patient needs to know you will gradually turn the tone up until it momentarily reaches an uncomfortable level. This critical information is of great benefit in the hearing aid fitting.

Use the attenuator and tone presentation controls to gradually increase the tone until the patient indicates you have reached uncomfortably loud.

Find discrete frequency UCLs for as many frequencies as possible.

**NOTE:** Be aware that when you change test frequency, you will need to turn the attenuator down a little to begin testing. Otherwise, your first tone presentation will be close to UCL, which will startle the patient.

The symbol for UCL (U) is automatically recorded on the audiogram. A blue U reports the left ear UCL and a red U reports the right ear UCL.

### **EXERCISE FOUR: REMOVING UNWANTED DATA FROM THE AUDIOGRAM**



To remove a whole curve, click the icons on the control panel corresponding to the data you want to remove. For example: click left ear, *AC*, *AUD*. Click *Discard*. All the left ear, air conduction values will be removed from the audiogram.

To remove discrete data points on the audiogram point the mouse to the unwanted value on the audiogram and right click the mouse button. This removes only a single data point on the curve.

### **Oops! I deleted the wrong data? How do I retrieve it?**

Go to *Tools* on the toolbar and select *Undelete*.

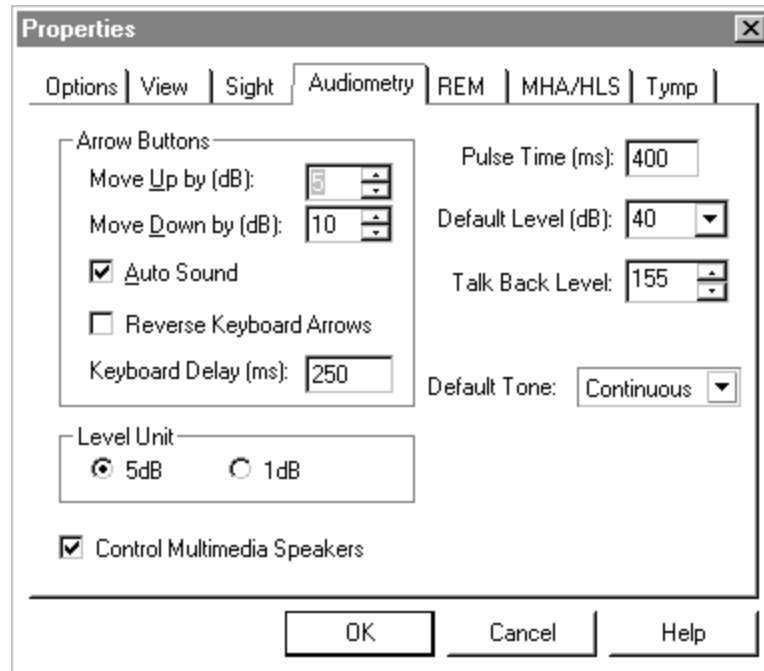
**EXERCISE FIVE: CUSTOMIZING AUDIOMETRY**

There are several ways to customize the Audiometry setup to suit your preferences. All customizing features are accessed from *Options* on the toolbar.

From the toolbar, go to **Options | Options**.

Set the Default Ear to your preferred first ear to test.

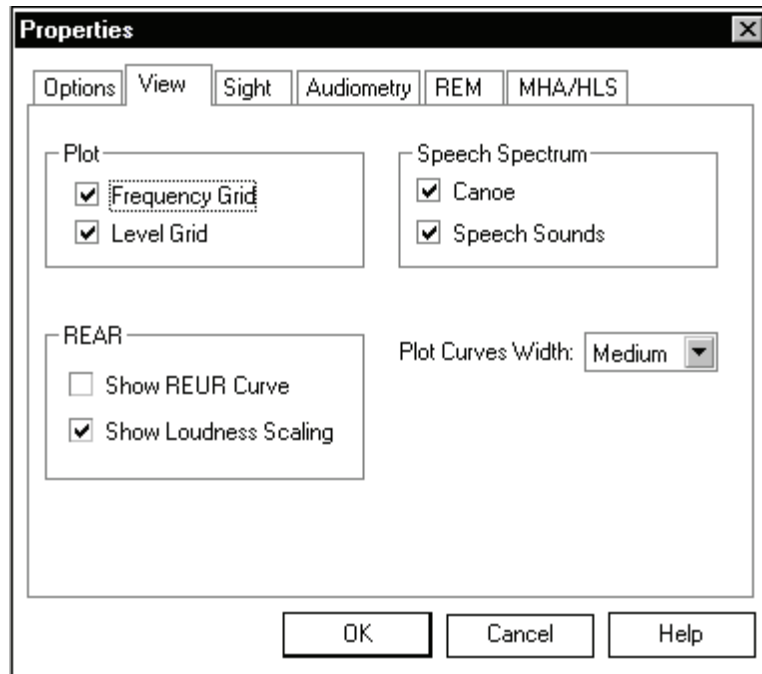
Click the *Audiometry* tab.



Features you can customize include: arrow icons (step size); Autosound; Keyboard delay time; pulse time; default level; talkback level; Level increments; default Tone and control of multimedia speakers.

Click *Help*. Read the description of all the audiometry properties. Close Help and make any changes to the setup to customize to your preferences.

Click the *View* tab. Properties you can customize include: speech spectrum - canoe and speech sounds; Plot curve width - thick, medium and thin. A check mark in the white box indicates the canoe or speech sounds will appear on the audiogram.



## LESSON FOUR

### Speech Testing

Speech testing provides information about the accuracy of the audiogram in addition to an indication of how well a patient may do with amplification.

The two most common speech tests performed in a hearing evaluation are the Speech Reception Threshold (SRT) and Discrimination Score (DS) tests.

#### EXERCISES

##### EXERCISE ONE: HOW TO FIND SPEECH RECEPTION THRESHOLD

##### EXERCISE TWO: USING THE DYNAMIC WORDLIST FEATURE IN SPEECH TESTING FOR THIRD PARTY COUNSELING

##### EXERCISE THREE: FIND MCL FOR SPEECH

##### EXERCISE FOUR: OBTAIN A DISCRIMINATION SCORE AT MCL

##### EXERCISE FIVE: FIND UCL FOR SPEECH

#### Setup for Exercises

Open a patient record with audiometric data or continue with the patient record used in lesson three.



Click *Audio* on the main menu.

#### EXERCISE ONE: HOW TO FIND SPEECH RECEPTION THRESHOLD

Click *SRT* on the Audiometry taskbar.

Go to *Tools* on the toolbar and click *Show PTA*. **Tools | Show PTA**

The Pure Tone Average (PTA) is automatically calculated for each ear from the audiogram and is useful to determine the level at which you start the SRT test.



Click the *Help* icon. Read the help topic for Speech Test Screen and become familiar with the SRT display and icons before proceeding with this exercise. Follow any link for further details.

Close the Help file to return to the SRT display.

#### SETUP FOR SRT

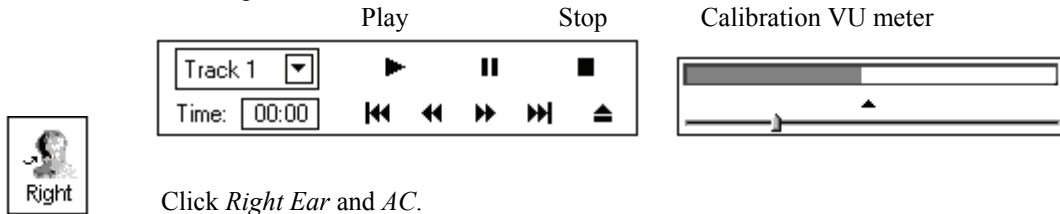


It is highly recommended you use the CD material for all speech testing.

Insert the wordlist CD into the CD ROM.

Click *CDLeft*. *CDLeft* is the default channel for adult word lists on the CD provided with the OtoWizard.

To calibrate the CD, click *Play* on the CD control panel. The first track on the CD is a 1kHz calibration tone. Look at the VU meter at the top of the display. The blue line on the VU meter needs to peak at the arrow marker. Adjust the level by dragging the *arrow* icon to the left or right as needed. Click the *Stop* icon on the CD control panel when calibration is successful.



Click *Right Ear* and *AC*.



Set the *Test dB* to the desired starting level.

Select *Track 2* on the CD. Track 2 is Adult Spondees.

Instruct the patient and insert the earphones.

FINDING SRT

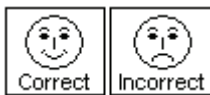


To start the test, click either *Play* on the CD control panel or *Signal OFF* icon. Signal OFF toggles to Signal ON when it is selected. These two controls operate interchangeably. Play is the same as Signal On and Stop is the same as Signal Off.

Monitor the test word by tracking the printed wordlist or by using the monitoring headset. Adjust the volume control to a comfort level when using the monitoring headset.

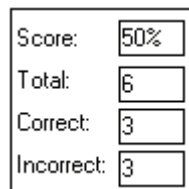
Monitor the patient's response. If you are using a two-way sound booth, you will have a talkback system in place to monitor the patient's response.

SCORING



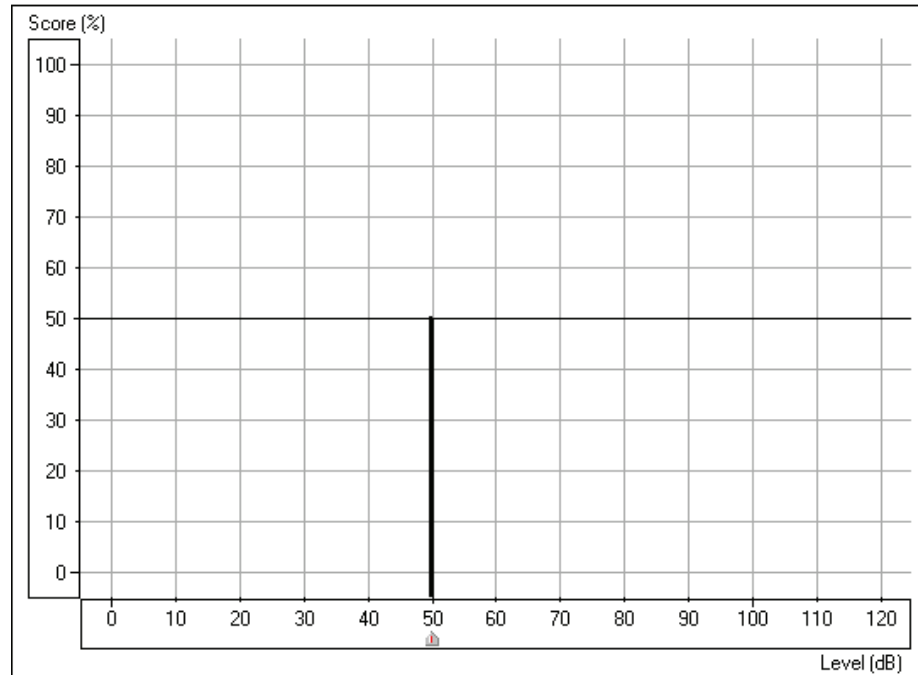
You can either use the mouse or keyboard to score the patient's response. Use the mouse to click the *Correct* or *Incorrect* icon for each response or press F7 for Correct and F8 for Incorrect on the keyboard.

The total score is updated automatically each time a response is scored as Correct or Incorrect.



In this example, six words were presented at the current test level. Three responses were correct and three were incorrect for a Score of 50%.

The SRT display shows a "dynamic" vertical line on the grid to show percentage correct at the current test level

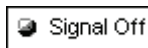


In this example, the SRT score of 50% is recorded at 50dB.

Your aim in SRT testing is to find the lowest level at which the patient scores 50% correct. Adjust the test level as required to find this level. Each time you change the test level, the score automatically resets to zero.

For example: Present the first 4 spondees. If the score is 75%, lower the presentation level and present another 4 words. If the score is now 25%, increase the presentation level and present more words. Continue to do this until you find the lowest level at which the patient scores 50%.

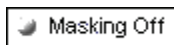
Use the *pause* icon on the CD control panel while you change the test level. You will not need to do this once you have practiced SRT testing as you will find you have adequate time between words to change the test level without pausing the CD.



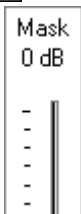
Click *Stop* or *Signal Off/On* when the test is complete.

Find SRT for the other ear.

MASKING



When masking is required, click *Masking Off* to turn the masking narrow band noise on. The icon will now indicate Masking ON. Masking noise automatically routes to the non-test ear. Therefore, if you are testing right bone conduction and you select Masking, the masking noise automatically routes to the left insert earphone. Remember to place the air conduction insert earphone in the non-test ear for masking.



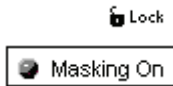
Set the masking level by adjusting the Mask level attenuator.



Turn masking off by clicking the *Masking On* icon. The icon will now say *Masking OFF*.

LOCK MASKING LEVEL TO THE TEST LEVEL

When masking, it is sometimes useful to determine a minimum masking level for a test level and then “lock” the masking attenuator to change with the test level. To do this, first set the attenuator to the test level and then determine the minimum effective masking level needed in the non-test ear and set the mask attenuator to this level. Now click the *Lock* icon and *Masking On*. All you have to do now is adjust the test level attenuator to find the masked threshold. The masking level will automatically adjust to the new test level as you seek threshold.



EXERCISE TWO: USING THE DYNAMIC WORDLIST FEATURE IN SPEECH TESTING FOR THIRD PARTY COUNSELING

Use the Wordlist feature to involve a third party in the speech testing process. This feature allows the third party to see the speech test words "flash" on the screen before hearing the patient's response. This process provides real time counseling on how the hearing loss effects understanding speech.

Setup for Wordlist:



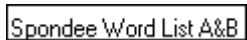
Click *Right Ear*.

Insert the speech CD into the CD ROM.

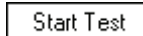
Calibrate the CD using the method described in Exercise One above. Note: calibration is required the first time the speech CD is used since turning the OtoWizard on.

Go to *Tools* on the toolbar and select *Speech Word List test*.

**Tools | Speech Wordlist Test.**



Click *Spondee Wordlist A & B*.



Click *Start Test*.



The Spondee wordlist now appears on the speech test control panel with the first word highlighted.

With the third party watching the screen, present the first word. To present the first word, click *Play* on the wordlist control panel or press *F9* on the keyboard.

The test word "flashes" on the screen.

Listen to the patient’s response.

Score the patient's response as correct or incorrect, using either the *Correct* or *Incorrect* icons or the *F7* for correct or *F8* for incorrect.

Present each successive word on the list, scoring each response. Click the *forward* (>>) icon or press *F10* on the keyboard to move to the next word.

Find the patient's SRT in the same manner as outlined in exercise one.



When SRT is determined for the right ear, click *Left* Ear and continue with the next word on the list. Use the PTA for the left ear to select a new start test level before presenting the next word.

Click *Stop* on the wordlist control panel to end the test. The word list is removed from the display.

### **Optional activity:**

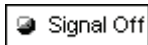
#### **SETUP FOR MICROPHONE (LIVE VOICE) PRESENTATION MODE**



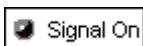
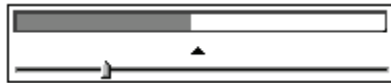
Click *Right Ear*, *AC* and *Mic*.

Position the microphone close to your mouth.

Set the *Test level* attenuator to 0dB.



To calibrate the microphone, click *Signal Off / On* icon. Speak at a normal voice level. It is useful if you repeat a spondee a few times over. Monitor the speech VU meter at the top of the display. The maximum energy of the spondee should peak at the calibration marker, where the blue line meets the red line. Adjust the VU meter using the *arrow* icon on the meter until the level is calibrated.



When you have calibrated the microphone, click *Signal Off/On* to turn the microphone off until you are ready to test. The icon should now display Signal Off.

Set the start level on the Test dB bar. You can use the PTA under Tools to guide you in deciding what level to start the test.

Click *Signal Off/On* when you are ready to present the first word. Remember to monitor your voice level on the VU meter and make sure you peak at the calibrated level. Score each patient response as correct or incorrect using the appropriate mouse or keyboard options.

Find SRT for each ear.

Turn the microphone off by selecting the *Signal ON / Off* icon to end testing,

### **EXERCISE THREE: FIND MCL FOR SPEECH**



Discrimination Score

Click *Discrimination Score* on the Audiometry taskbar.



Click *Help*. Read the help file on Discrimination Score. Become familiar with the task description, display and icons used in this test.



The Discrimination Score control panel has three icons that are not used in SRT. These are the AUD, UCL and MCL icons. These icons are used to ensure the appropriate symbol is recorded on the display to represent a discrimination score, the UCL level or the MCL level.

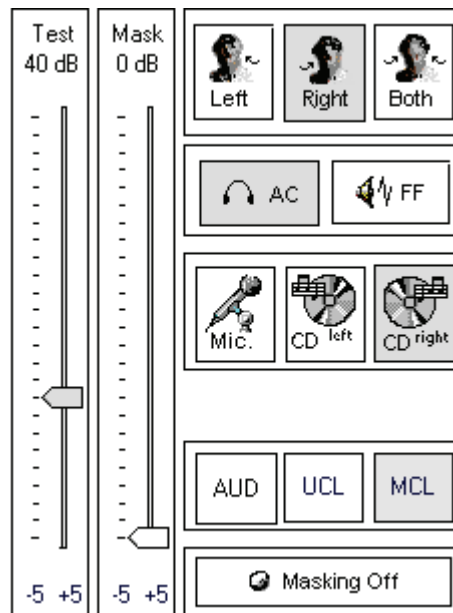
You will need to find the patient's Most Comfortable Level (MCL) for speech material before obtaining a discrimination score.

Setup for finding MCL using the Auditec CD

Click *Right Ear, AC, CD Right, MCL*.

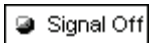
Insert the speech CD into the CD-rom.

Set the *Test level* dB attenuator to 40dB.



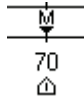
Select Track 14 on the CD control panel. This track plays continuous discourse, which is the preferred material for finding MCL.

Instruct the patient. Carefully explain to the patient that you will turn the volume up gradually. The patient needs to tell you when they can hear the voice at a comfortable level, similar to their preferred volume for the radio or television.



Click *Signal Off/On* icon or *Play* on the CD control panel.

Gradually increase the volume and monitor the patient's response. Choose one of the three methods to adjust the attenuator: Use the up arrow key on the keyboard or click the *arrow* icon on the attenuator bar or hold the mouse button down and drag the *arrow* icon slowly up the attenuator Test dB bar.



Look for the MCL (M) symbol on the bottom of the Discrimination Score results grid as it tracks with the attenuator.

When your patient indicates you have reached MCL, select the *pause* button on the CD player.



Click *Left* Ear and find MCL for the left ear.

You have now obtained the patient's speech MCL for each ear.

#### BINAURAL MCL



To find binaural MCL, click the *Both* icon.

Set each attenuator, Left and Right, to 5dB below the monaural MCL dB level determined previously.

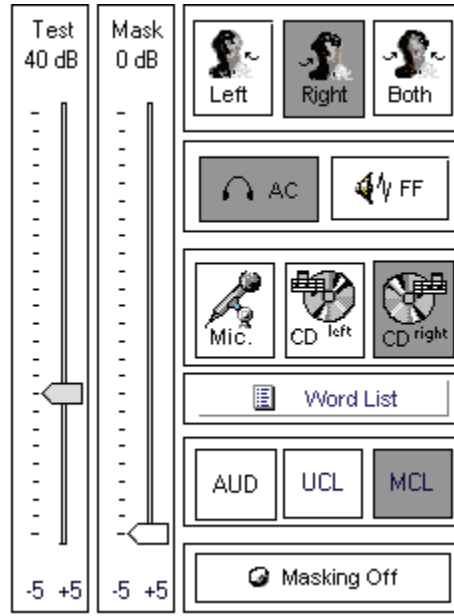
Present Track 14 in the same manner as for monaural MCL, and adjust the Left and Right attenuators according to the Patient's perceived comfortable level.

Note: If you intend on finding a discrimination score at the patient's MCL, you may wish to stay with the right ear before switching to the left ear to find MCL. The next exercise takes you through the steps to obtaining a discrimination score at MCL.

#### EXERCISE FOUR: OBTAIN A DISCRIMINATION SCORE AT MCL

It is useful to obtain a score of speech discrimination or word recognition at the patient's most comfortable listening level. The result provides an idea of how well the patient may do with amplification.

#### Setup



Click *Right*, *AC*, *CDLeft* and *AUD*.

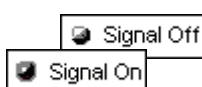
Set the attenuator to the MCL level determined in the preceding exercise.

Select your preferred wordlist. Refer to the inside cover of the speech CD to locate the list of your preference. Select this track number on the CD control panel.

Instruct the patient. Make sure you can hear the patient's response, whether you use a one room or remote microphone setup.

Make sure the insert earphones are inserted appropriately.

Note: If a third party is present, you may wish to use the Dynamic Wordlist presentation mode to present the test words. A special section at the end of this exercise steps you through this option. For now, follow the steps as described below.

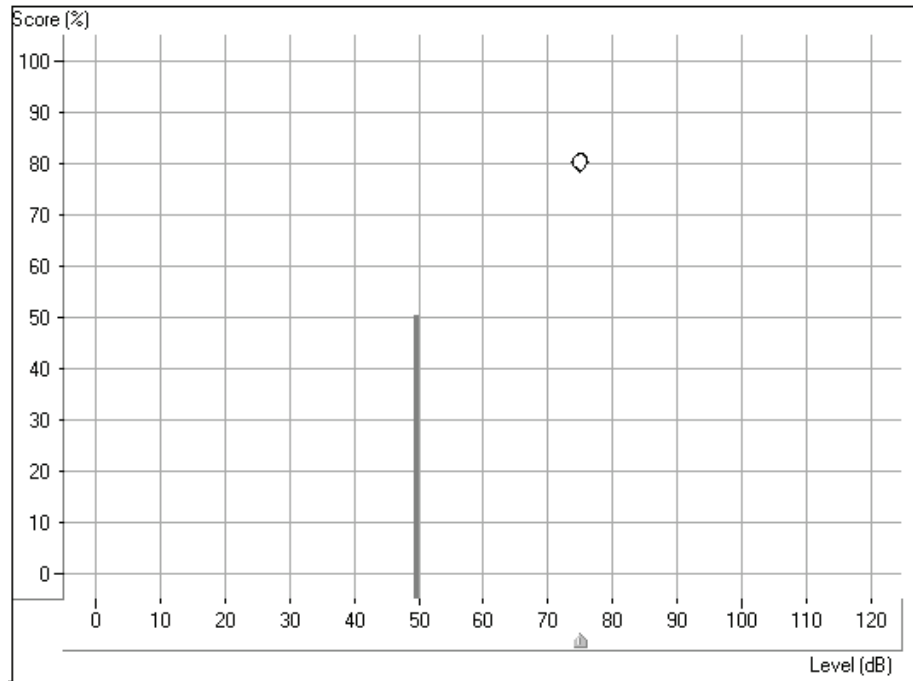


Click the CD control *Play* icon or *Signal Off/On* to start the test.

Monitor the test words by tracking the printed list of words or use the monitor headset.

Score each response. Click *Correct* or *Incorrect* or use the keyboard keys F7 for correct and F8 for incorrect.

The score is automatically plotted to the display and is continuously updated for each response. The score indicates the percentage correct at the test level.



In the above example, a discrimination score of 80% was obtained at a test level of 75dB.

The solid vertical line at 50dB represents the SRT for the same ear.

You can also monitor the status summary textbox under the control panel. This reports the current score, total number of words presented, number correct and number incorrect.

Score:	80%
Total:	20
Correct:	16
Incorrect:	4

When the desired number of words has been presented, click *pause* on the CD control panel.

At this point, you may want to present more words at a new test level. Set the attenuator to the new level and click *Play* to proceed. A new score is obtained for the new test level.



When you have finished with the right ear, repeat the procedure for the *Left* ear.



BINAURAL DISCRIMINATION SCORE

To obtain a binaural discrimination score, click the *Both* icon.

Adjust both the left and right attenuators to the desired input levels.

Select the wordlist track to be presented.

Score the patient's responses in the same manner as described in the previous monaural discrimination score task.

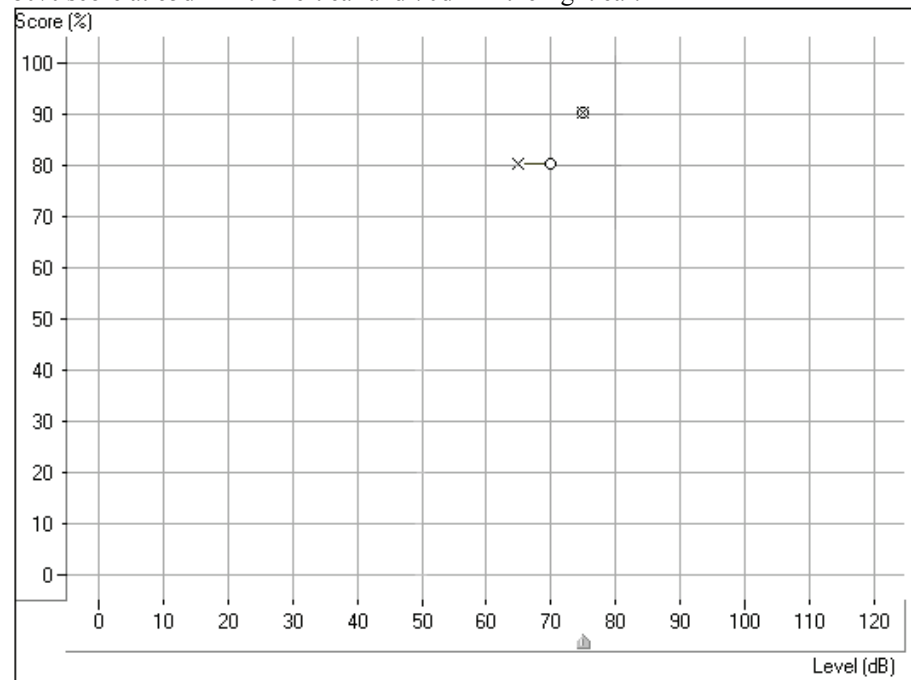
The test results are plotted to the grid in the following manner:

A red circle indicates the test level in the right ear and a blue cross shows the test level in the left ear.

The results in the diagram below are:

90% score at 75dB in both the right and left ear

80% score at 65dB in the left ear and 70dB in the right ear.



USING THE DYNAMIC WORDLIST PRESENTATION MODE FOR DISCRIMINATION SCORE

Alternatively, you can display the words on the screen for yourself or a third party by using the Dynamic Word List feature.

Setup the control panel by selecting *Right*, *AC*, *CDLeft* and *AUD*.

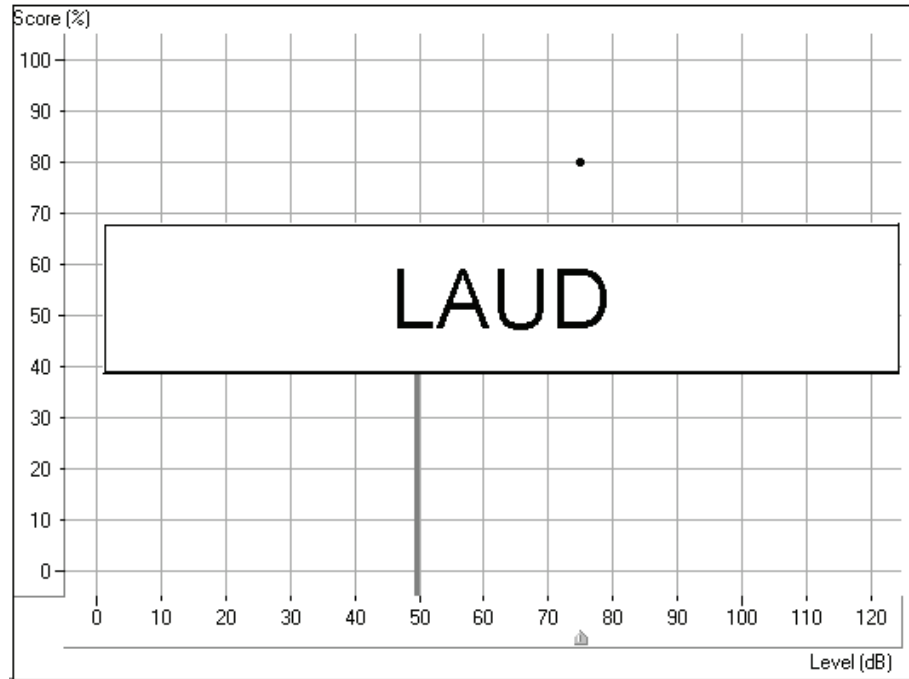
Go to *Tools* on the toolbar and select *Speech Word List Test*.

**Tools | Speech Word List Test.**

Select the Word list preferred, and *Start Test*. Example: select NU 6 or W22 wordlist.

**Play** Click *Play* on the Wordlist control panel or press the *F9* key on the keyboard to present the first word.

The word appears in large text at the center of your screen.



Score the patient's response as correct or incorrect, using either the *Correct* or *Incorrect* icons or the *F7* or *F8* keys respectively.



Click *forward* or press *F10* on the keyboard to present each successive word on the list. Remember to score each response to a test word.



Present the desired number of words to obtain a Discrimination Score.

Repeat the procedure for the Left ear.



Click *Stop* to end the wordlist test and return to the default control panel display.

**EXERCISE FIVE: FIND UCL FOR SPEECH**

While obtaining discrete frequency UCL data using pure tones is highly recommended in Audiometry, it is sometimes useful to obtain a UCL using speech material.

Setup for UCL

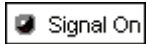
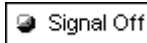


Click *Right Ear*, *AC*, *UCL* and *CDRight*.

Select Track 14 on the CD (continuous discourse)

Set the attenuator to the patient's MCL.

Instruct the patient carefully. Explain to the patient that you will turn the volume up gradually. The patient needs to tell you when they can no longer tolerate the sound, even for a few seconds. Look for the "crows feet" to appear around the patient's eyes.

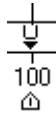


Click *Play* on the CD control panel or *Signal Off/On* icon.

Gradually increase the attenuator level until the desired UCL response is obtained. Choose one of the three methods to adjust the attenuator: Use the up arrow key on the keyboard or click the *arrow* icon on the attenuator bar or hold the mouse button down and drag the *arrow* icon slowly up the attenuator Test dB bar.



**Immediately** click the *Stop* icon on the CD control panel or the *Signal On /Off* icon when the patient indicates UCL.



The UCL level is indicated on the display as a U symbol below the discrimination score results grid.

**SUMMARY**

**Is there an easy way to view all the speech test results?**

A summary of the speech test results is displayed on the Audiometry screen.

Click *Audiometry* on the taskbar.

At the bottom of the screen, the speech test results are displayed in the following table:

	SRT	DS	MCL	UCL
Left:	45dB	94% at 75dB	75dB	100dB
Right:	50dB	87% at 70dB	75dB	100dB
Both:	45dB	87% at 75dB	75dB	95dB

Note: The “best” scores are imported to this summary box.

## LESSON FIVE

### Hearing Loss Simulator and Master Hearing Aid

#### Part One: Hearing Loss Simulator

The Hearing Loss Simulator is an extremely powerful counseling tool for the third party. The exercises in this Lesson introduce you to three main applications of the Hearing Loss Simulator.

#### EXERCISES

**EXERCISE ONE: SIMULATE THE DIFFERENCE BETWEEN NORMAL HEARING (NORMAL) AND THE PATIENT'S HEARING LOSS (SIMULATED)**

**EXERCISE TWO: SIMULATE THE POTENTIAL IMPROVEMENT IN THE PATIENT'S HEARING PERFORMANCE WHEN HEARING INSTRUMENTS ARE WORN.**

**EXERCISE THREE: USE THE HEARING LOSS SIMULATOR TO SIMULATE THE NATURAL DETERIORATION IN THRESHOLDS OVER TIME**

#### Prepare for Exercise One

If you are continuing straight on from Lessons Three or Four, you can continue to work with the current patient's record. Go directly to Exercise One.

Otherwise, follow the instructions below to Open a Patient Folder.

#### Open a Patient Folder

There are two ways of operating the OtoWizard software. The first is as a stand-alone program from the desktop. The second is to run the OtoWizard from within NOAH after you have installed the OtoWizard measurement module in NOAH.

Select from the two approaches described below to open a patient's folder.

#### OtoWizard stand-alone program:



Click *OtoWizard* on the desktop to start the program.



Patient

Click *Patient*.

Click on a patient's name from the list in your database.



Open

Click *Open*.



New Record

Click *New Record*.

Enter details as appropriate until a new record for today's appointment is created.





Click *Use Record*. The main menu for the OtoWizard is now on your screen.

**OR**



Running the OtoWizard under NOAH:

Open *NOAH* from the desktop.

Open the patient's folder (Client).



Click the measurement module ( $\Omega$ ) icon on the toolbar. The OtoWizard main menu appears on your screen.

**EXERCISE ONE: SIMULATE THE DIFFERENCE BETWEEN NORMAL HEARING (NORMAL) AND THE PATIENT'S HEARING LOSS (SIMULATED)**

SETUP FOR HEARING LOSS SIMULATOR



Click the *MHA / HLS* icon from the main menu screen.

There are three tabs on the taskbar. The first is AUDIO. This screen shows the patient's audiogram for the current record. It displays the data for the test ear selected on the control panel. If the current record has audiometric data, it will automatically import to this display.

Manual entry of audio data: If there is no audiometric data in the current record, you can manually enter the audiogram in the AUDIO screen. Click *Right Ear* and *AC* on the control panel and simply point the mouse to the value on the audiogram, example 30dB at 1000Hz, and click the mouse button. The appropriate AC symbol for right ear air conduction threshold is plotted to the audiogram. Click *Left Ear* and enter air conduction values for the left ear.



For the purposes of this exercise, enter the following audiogram values for the *Right Ear*:

20 at 250, 30 at 500, 40 at 1000, 50 at 2000, and 60 at 3000, 4000, 6000 and 8000Hz.

**!!!!Note:** Any time you make changes to audiogram data in a screen with the title AUDIO, you are making permanent changes to the record. The only screen where you can make changes to the audiogram data and NOT effect the data stored in the opened record is in the Hearing Loss Simulator (HLS) screen.



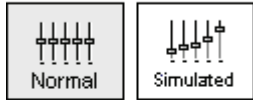
Click the *HLS* tab on the taskbar.



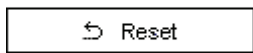
Click *Help* and read about Hearing Loss Simulation. Follow the link to the Hearing Loss Simulator icons and become familiar with the icons used in this demonstration.



Click *Right Ear*, *Normal*, and *CD*.



Make sure the speakers used by your system for the Hearing Loss Simulator are connected to the system and turned on. Click the icon on the control panel that corresponds to the speaker type you are using. (*Free Field* or *Box*)



Insert the MedRx Sound Sensations CD in the CD ROM.



Select *Track 2* on the CD control panel.

Explain the audiogram to the third party. Pay special attention to the speech area.



Explain the simulation. First, the third party will listen to music in the Normal mode. When you click *Simulated*, the third party will hear the music adjusted for the patient's hearing loss.

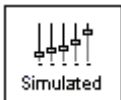
Position the third party so that they are near the speakers and can view the monitor easily.



Click *Play* on the CD control panel.



Adjust the volume control if the third party has difficulty hearing the music. Click *-1* or *-1* icons to increase or decrease the volume respectively. In most cases, you will not need to adjust the volume.

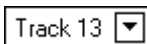


Allow the third party to listen to the music for 20 - 30seconds, reinforcing that this is how the third party normally hears this music.

Click *Simulated*. Tell the third party that they are now listening to the patient's hearing loss.

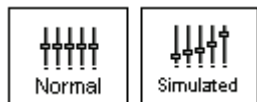


Alternate between *Normal* and *Simulated* so that the third party can appreciate the difference.



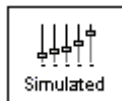
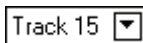
Repeat the simulation with *Track 13*, which is a female voice in quiet.

Alternate between *Normal* and *Simulated*.



This provides a good demonstration of why the patient says the third party "mumbles". The hearing loss makes it sound like the female voice is mumbled.

The next track demonstrates how the patient's hearing loss can affect their safety.



Select *Track 15* and click *Simulated*. Press *Play* on the CD control panel and ask the third party to identify the sound. It will take some time until the third party recognized the approaching train whistle.



When they have identified the sound, press *stop* and replay track 15 in the normal mode. Click *Normal* and then *Play*.

This is an effective demonstration of how the patient may not be hearing important environmental sounds for safety.

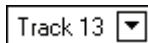
**EXERCISE TWO: SIMULATE THE POTENTIAL IMPROVEMENT IN THE PATIENT'S HEARING PERFORMANCE WHEN HEARING INSTRUMENTS ARE WORN**

This also provides an opportunity to set the third party's expectations for the benefits and limitations of hearing aids.

Setup



Click *Simulated*. Select *Track 13* on the CD control panel.



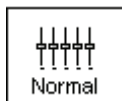
Explain that you are now going to simulate the potential improvement a hearing aid can make to the patient's hearing.

Click *Play*.

The third party is listening to the female speaker on Track 13, adjusted for the hearing loss. Improve the patient's thresholds by applying a half gain rule to the audiogram values. Simply point and click on the audiogram to the improved threshold level.

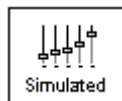
For example: For the hearing loss entered in this lesson, you will now point and click to 10 at 250, 15 at 500 20 at 1000, 25 at 2000 and 30 at 3000,4000,6000 and 8000Hz.

You do not need to be precise in this step as you are performing a “simulation” of the potential benefit.

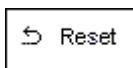


As you improve the threshold at each frequency, the female's voice becomes clearer.

At this point, click the *Normal* icon. Explain to the third party that while you can dramatically improve the hearing performance with hearing instruments, it is still not normal hearing.



With the track still playing, click *Simulated* again. Remind the third party that with the hearing aid, the patient hears better than without the hearing aid. To demonstrate this, click the *Reset* icon on the control panel. This resets the audiogram to the patient's original hearing loss values.



You can repeat this simulation with a variety of tracks on the CD.

This simulation provides the third party with the experience and understanding that hearing instruments have great potential to benefit the patient. It also helps the third

party not to expect the patient to have normal hearing, even with hearing instruments.

**EXERCISE THREE: USE THE HEARING LOSS SIMULATOR TO SIMULATE THE NATURAL DETERIORATION IN THRESHOLDS OVER TIME**

This demonstration helps consolidate your recommendation for the patient to be fitted with the flexibility of programmable technology, which allows the hearing instrument to "grow" with the hearing loss for the life of the instrument.

It is useful to simulate the effect of a drop in the patient's hearing. Most presbycusis hearing losses are characterized by gradually declining hearing thresholds. It is not unusual to see a drop of 5 to 10dB in thresholds over a 3-year period. This simulation is used in conjunction with your recommendation to fit programmable hearing instruments that can be adjusted for changes in hearing levels for the life of the hearing aid. This adds validity to the added cost of high-end program hearing instruments.

Setup



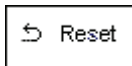
Click *Simulated*.

Select your preferred CD track.



Click *Play*.

Manually change the audiogram thresholds by 5 -10dB for all frequencies across the frequency range. Simply point and click the mouse to a threshold 5dB below the current threshold on the audiogram. While this does not "appear" to be a significant change on the audiogram, it is usually enough of a drop in hearing performance for the third party to hear.



To return to the original audiogram, click the *Reset* icon.

## Part Two: Master Hearing Aid

It is highly recommended you use stock demonstration hearing aids as Master Hearing Aids whenever you have them available. Providing the patient with the experience of listening to a "real" hearing instrument is a superior demonstration to a master hearing aid. However, the Master Hearing Aid provided in the OtoWizard is a quick way to simulate the potential benefit of hearing instruments to a patient who has never worn hearing aids before.

### SETUP FOR MASTER HEARING AID



Click the *MHA / HLS* icon from the main menu screen.

The first screen is AUDIO. If you do not have a current patient record open, manually enter air conduction thresholds for one ear on the audiogram.

For the purpose of this exercise, enter the following audiogram for the *Right Ear*:

20 at 250, 30 at 500, 40 at 1000, 45 at 2000, 50 at 3000, 55 at 4000, 6000 and 8000Hz.



Click *MHA* on the taskbar.

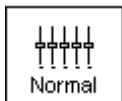


Click *Help* and become familiar with the screen and icons for Master Hearing Aid.

Close the Help file from the *X* icon to return to the Master Hearing Aid exercise.



Select *Right Ear*.



Select *Normal*.

The program automatically reads the patient's audiogram data and plots gain curves to the display. The default gain rule applied to the thresholds is the NAL(R) rule. This rule applies well to most hearing losses for comfort level hearing.

Exceptions: For very mild hearing losses, select the 1/3 Gain rule.

For very severe hearing losses, select the 1/2 Gain rule.

A gain curve is plotted for each ear. The highlighted (green) curve is determined by which test ear icon you have selected on the control panel.



Click either the *Mic or CD* icon. Mic allows you to use your own voice, or third party's voice, as the input signal. The input microphone is the talkover microphone used on your system. If you use the CD, make sure the Sound Sensations CD is in the CD ROM drive. This option provides you with greater variety and control of the sounds used in the simulation.



Click *Binaural*. This allows the prescribed gain to go to each ear simultaneously, to simulate a binaural fitting.

Instruct the patient. The patient will begin by hearing the sound unchanged. When you click the Simulated icon, the patient will hear the simulated hearing aid effect on the sound.

Place the insert earphones on the patient.

Position the patient so that they can view the monitor.

If using the CD, select the preferred track and press *Play*. If using the Mic, begin conversing with the patient at a normal speaking level. Remember to always maintain a constant distance from the microphone throughout this demonstration.



Allow the patient to listen for a few seconds, and then click *Simulated*.

Continue presenting the signal, whether by CD or Mic.

The patient should now be able to notice a significant change in the clarity of the signal.

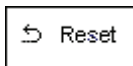
Repeat this simulation using a variety of CD tracks or familiar voices in the microphone input option.

Based on the patient's subjective response as to "how it sounds", you can make adjustments to the simulation by 1) editing the gain curves and 2) comparing monaural to binaural amplification.

### **1) Editing the Gain curve to customize the master hearing aid**

Adjust to comfortable volume: If the patient does not think the Simulated mode is comfortably loud in each ear, adjust the overall volume level using the +1 or -1 icons.

Sound is too "tinny"?: If the patient reports that the signal is too "tinny", you can reduce the high frequency gain or increase the low frequency gain by editing the gain plot on the display. To do this, select the ear icon to be adjusted and simply point to the preferred level of gain on the gain curve at any given frequency and click the mouse button. The gain curve plot changes to the new level. Make appropriate changes to the other ear gain curve. Monitor the patient's response as to how it sounds. At any time, to return to the original prescription gain levels, select the *Reset* icon.



### **COMPARING A MONAURAL TO A BINAURAL FITTING USING MASTER HEARING AID**

The OtoWizard Master Hearing Aid task automatically assumes a binaural fitting and applies gain for each ear. If you want to demonstrate a monaural fitting, either as a comparison to the binaural fitting or because only one ear is aidable, click the *Monaural* icon and proceed with the simulate versus normal demonstration outlined above. The non-test ear will not receive any stimulus.



## LESSON SIX

### Real Ear Measurements

This lesson focuses on the Real Ear Aided Response and provides a fast and accurate method for real ear measurement verification of hearing instrument fittings.

It is recommended you also perform Live Speech Mapping to verify hearing instrument fittings. Live Speech Mapping is covered in Lesson Seven.

#### Background

##### WHAT ARE REAL EAR MEASUREMENTS (REM)?

Real ear measurements are measurements of sound obtained with a probe tube microphone placed at the eardrum of the patient, therefore taking into account the specific external ear resonance characteristics.

A common approach for real ear measurements, until recent years, included steps to calculate a prescription based on hearing threshold levels, using known fitting rules to generate target insertion response curves. These target curves are a guide for the optimum adjustment of the hearing instrument amplification at the eardrum.

The current approach to real ear measurements looks more closely at the actual sound pressure level (SPL) at the eardrum. The target for aided measurements is the patient's own dynamic range of hearing, determined by their hearing thresholds and UCLs.

##### WHAT IS THE REAL EAR AIDED RESPONSE (REAR)?

The Real Ear Aided Response (REAR) is the sound pressure level in the ear canal measured with the probe microphone close to the eardrum and the operating hearing instrument inserted in the ear and turned on.

### EXERCISES

#### **EXERCISE ONE: REAL EAR AIDED RESPONSE (REAR) VERIFICATION OF HEARING INSTRUMENT FITTINGS USING SPEECH WEIGHTED NOISE**

#### **EXERCISE TWO: USING ICRA-NOISE TO VERIFY NON-LINEAR HEARING INSTRUMENT FITTINGS**

##### Preparation for Exercises

You must be familiar with the features of the hearing instrument you are fitting before the fitting appointment. Know how to program the hearing instrument and pre-set it for the fitting appointment. Make sure you follow the manufacturers' recommendations for evaluating hearing instruments with special adaptive and noise canceling features.

Pre-program the hearing instrument using the patient's audiometric data as appropriate.

Note: The hearing instrument can be programmed from the fitting module in NOAH or from manufacturer specific stand-alone programs installed on your OtoWizard. The exercises in Lesson Nine teach you how to program within NOAH. To use a stand-alone fitting program, minimize the OtoWizard program and open the manufacturer's fitting software from the desktop. Program the aid and return to the REAR screen using **Alt + Tab** keys on the keyboard. Press and hold the Alt key down and press once on the Tab key to toggle between the opened programs.

### **EXERCISE ONE: REAL EAR AIDED RESPONSE (REAR) VERIFICATION OF HEARING INSTRUMENT FITTINGS USING SPEECH WEIGHTED NOISE**

This exercise can be performed using any composite noise stimulus option on the control panel. For the purposes of this lesson, we will use the Speech Weighted Noise (SWN) option.



Click *REM* from the main menu screen.



The first screen is **AUDIO**. The program automatically retrieves the patient's audiogram values in the patient's current record.

For the purposes of this exercise, manually enter the following audiogram values for the *Right Ear, AC* on the audiogram:

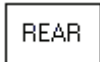


20 at 250, 30 at 500, 40 at 1000, 50 at 2000 and 60 at 3000, 4000, 6000 and 8000Hz.



Click *UCL* and enter the following values:

100 at 250, 100 at 500, 95 at 1000, 95 at 2000, 90 at 3000, 90 at 4000, 6000 and 8000Hz.



Click *REAR* on the taskbar.

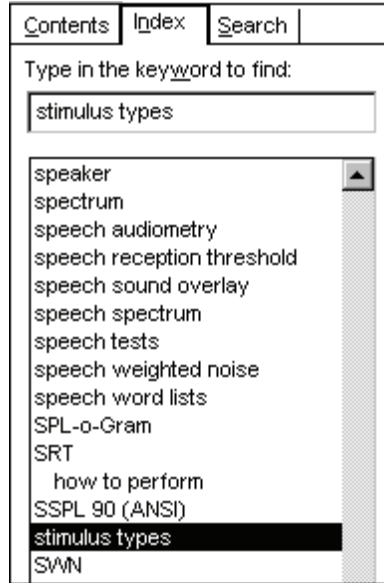


Click *Help* and become familiar with the display and icons used in this function.

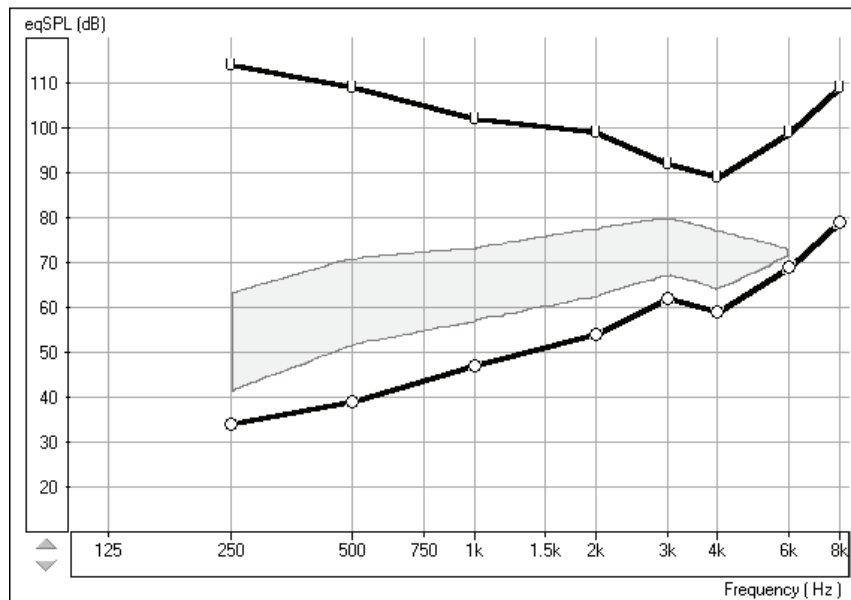
Click *Index* on the help menu.

Type stimulus types in the search box for Help Index. Read the help file on stimulus types for a description of the control panel options for stimuli used in the REAR task.





Close the help file using the *X* icon.



REAR display

Explain the REAR display to the patient and third party. The display still shows the patient's hearing loss and tolerance levels, however this time the graph represents soft sounds at the bottom and very loud sounds at the top. I.e. It is in dB SPL. Until sounds reach the hearing threshold levels, the patient cannot hear the sounds. When the sounds go higher than the U symbols, they become intolerable.



Perform an otoscopic inspection of the patient's ear canal. Use the Video Otoscope preview mode by clicking on the *camera* icon on the toolbar.



Back

Click the *Back* icon to return to the REAR screen.

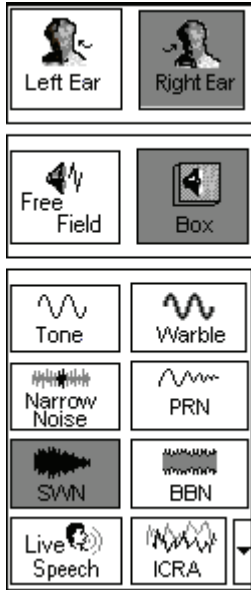
Insert the probe microphone into the patient's right ear canal.

With the probe microphone still in the ear canal, insert the patient's hearing aid in their ear. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

Position the patient facing the box loudspeaker at a distance of no more than 3 feet.

TEST AT COMFORT LEVEL

Make sure you have *Right Ear*, *Box* and *SWN* selected on the control panel.



Set the test level to *65dB*.

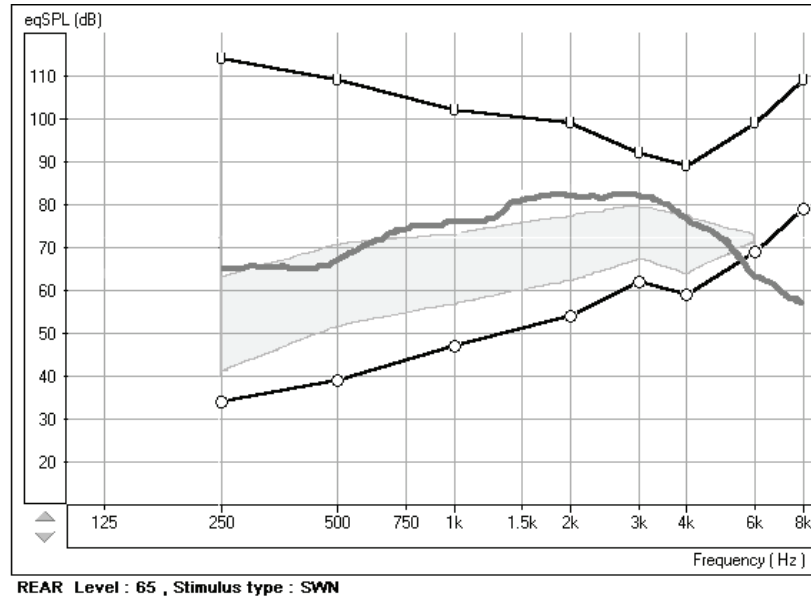


Click *Start*.

The system will generate a SWN signal at the loud speaker and adjust the level to be 65dB at the free field reference microphone at the entrance to the patient's ear canal.

The system records the SPL measured by the probe microphone at the patient's eardrum. This curve is plotted automatically to the REAR screen.

Aim to have the aided response curve for the 65dB input curve to be half way between the patient's hearing thresholds and their UCLs, as in the following diagram.

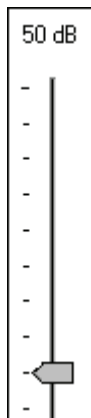


Make any programming changes to the hearing instrument as required and repeat this measurement until the curve is half way between the patient's hearing thresholds and their UCLs.



Discard all unwanted curves. Point and click the mouse on the unwanted curve and then click the *Discard* icon.

TEST AT SOFT LEVEL



Adjust the test level to *50dB*.

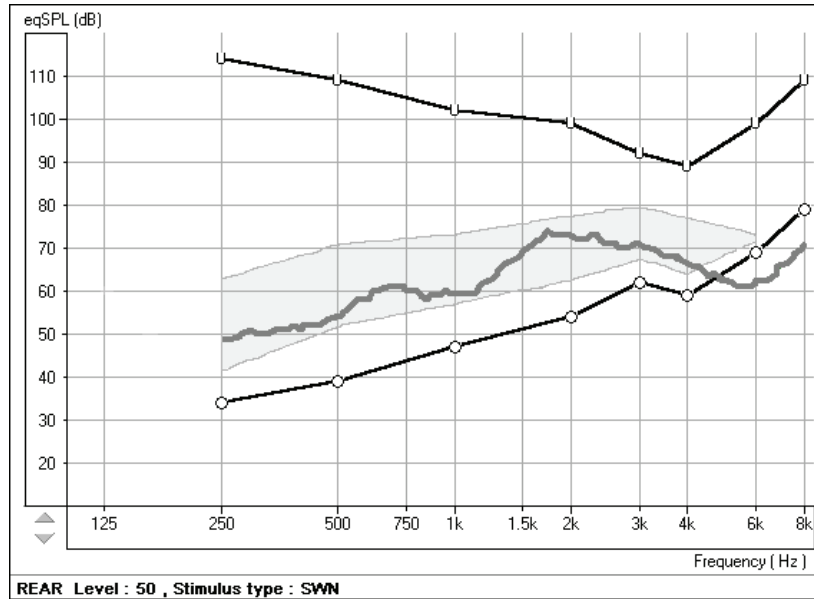
Make sure the test environment is quiet.

Note: If you know that the ambient noise level in the test room is louder than 50dB, you will need to set the test level to 55dB or 60dB, as appropriate.

Click *Start*.



The REAR curve for a 50dB (soft) input should be above the hearing thresholds for as many frequencies as possible.

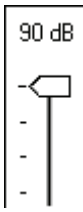


Adjust the gain or kneepoint setting on the hearing instrument to make this soft sound audible for as many frequencies as possible.

Repeat the measure at 50dB after each adjustment to the hearing instrument to verify audibility.



Discard all unwanted curves. Point and click the mouse on any unwanted curve and click the *Discard* icon.



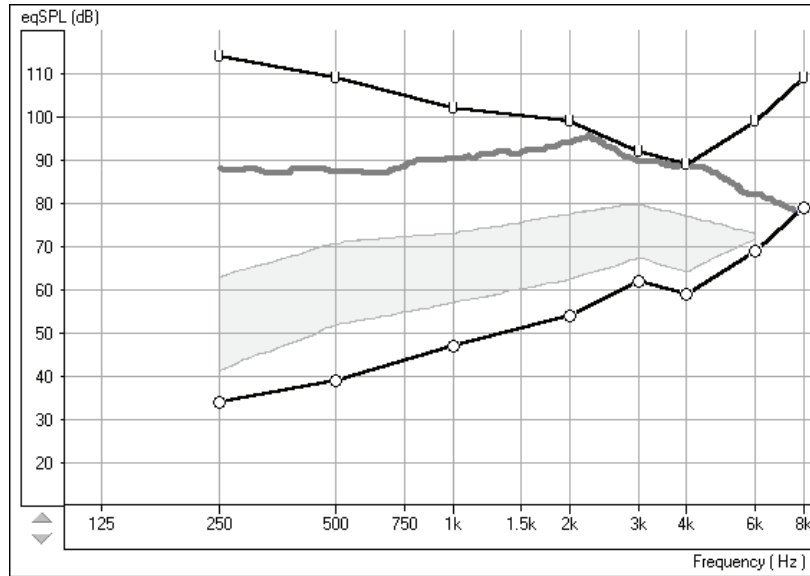
TEST AT LOUD LEVEL

Adjust the test level to *90dB*.



Click *Start*.

Make sure the REAR curve for the 90dB (loud) input never exceeds the patient's UCLs at any frequency.



REAR Level : 90 , Stimulus type : SWN

Adjust the compression or limiting settings on the hearing instrument as required.

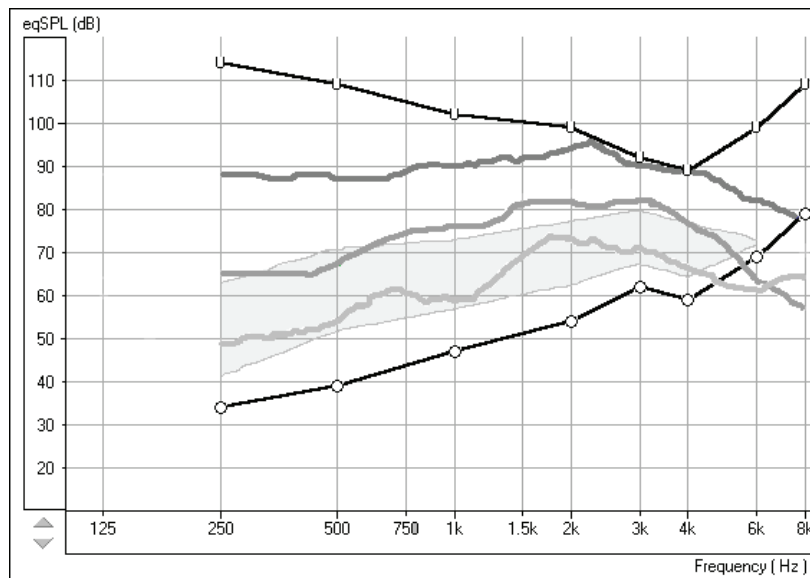
Repeat the 90dB curve to verify the effectiveness of these adjustments.



Discard all unwanted curves. Point and click the mouse on the unwanted curve and then click the *Discard* icon.






**SUMMARY**

At the end of this exercise, you will have three acceptable curves on the display.



REAR Stimulus type : SWN

Note: The Legend at the lower left corner of the display provides a color-coded description of each curve on the display.

	REAR: \$WN, 50dB
	REAR: \$WN, 90dB
	REAR: \$WN, 65dB
	Air Conduction: AI= 27%
	Uncomfortable level

### Further exercises

One of the most dynamic and powerful methods for verifying hearing instrument fittings is to do Live Speech Mapping in Real Ear Measurements.

Refer to Lesson Seven.

### EXERCISE TWO: USING ICRA-NOISE TO VERIFY NON-LINEAR HEARING INSTRUMENT FITTINGS

ICRA-Noise is a new stimulus designed for testing non-linear hearing instruments.

One method for using the ICRA-Noise stimulus options is outlined below.



Click *ICRA* on the control panel.

Click the *down arrow* icon beside the ICRA icon.

From the drop down track options, select Track 4, 1 Female 3-band single speaker. This is a measure of response of the aid for a female voice at comfort level.

Set the level to the patient's MCL.

With the probe microphone still in the ear canal, insert the patient's hearing aid in their ear. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

Position the patient facing the box loudspeaker at a distance of no more than 3 feet.



Click *Start* or press Enter on the keyboard.

The stimulus level will be adjusted automatically before the ICRA noise is initiated. The sampling time recommended is 20 - 30 seconds. The sampling time is either pre-determined in the program or can be set under **Options | Options | Average Time (sec)**.

The REAR curve stored to the screen is an FFT analysis of the output measured at the probe microphone for the duration of the stimulus.

Aim to have the peaks of the curve follow the top of the aided speech spectrum.

Repeat this procedure using Track 5, 1 Male 3-band single speaker.

Again, aim to have the REAR curve peaks at the top of the aided speech spectrum.

Test at Loud Level



Click the *down arrow* icon next to the ICRA icon.

Select Track 9, 1 female + 1 male and 2 female + 2 male, loud voice spectra.



Do not adjust the attenuator Test level. Keep the test level at the patient's MCL.

Click *Start* or press Enter.

The REAR curve stored to the screen should not exceed the patient's UCL at any frequency.

## LESSON SEVEN

### LIVE SPEECH MAPPING

Live Speech Mapping in Real Ear Measurements (REM) provides a dynamic presentation of how much "speech" is reaching the patient's eardrum. When measured in the unaided ear canal, this function is used to counsel the patient and third party on the effect of the hearing loss on understanding speech. A better understanding of the hearing loss usually makes it easier for the patient and third party to accept and commit to rehabilitative help. Live Speech Mapping is also a fast and accurate approach to successfully program hearing instruments for fitting and troubleshooting.

The four exercises in this lesson teach you the utility of dynamic Live Speech Mapping in real ear measurements.

#### EXERCISES

**EXERCISE ONE: DEMONSTRATE THE HEARING LOSS TO THE PATIENT AND THIRD PARTY USING LIVE SPEECH MAPPING IN THE UNAIDED EAR**

**EXERCISE TWO: USE LIVE SPEECH MAPPING TO UPGRADE A PATIENT FROM LINEAR HEARING AIDS TO HIGH END PROGRAMMABLE HEARING INSTRUMENTS**

**EXERCISE THREE: DEMONSTRATE HIGH END TECHNOLOGY HEARING AIDS TO A NEW PATIENT USING LIVE SPEECH MAPPING**

**EXERCISE FOUR: VERIFYING AND TROUBLESHOOTING HEARING INSTRUMENT FITTINGS USING LIVE SPEECH MAPPING**

#### Preparation for Exercise One

If you are continuing straight on from a preceding Lesson, you can continue to work with the current patient's record. Go directly to Exercise One.

If you are not continuing from Lesson Four, follow the instructions below to Open a Patient Folder.

#### **Open a Patient Folder**

There are two ways of running the OtoWizard software. The first is as a stand-alone program from the desktop. The second is to run the OtoWizard from within NOAH after you have installed the OtoWizard measurement module in NOAH.

Select from the two approaches described below to open a patient's folder.



#### I. OtoWizard stand-alone program

Click the *OtoWizard* icon on the desktop to start the program.



Click *Patient*.

Click on a patient's name from the list in your database.





Click *Open*.



Click *New Record*.

Enter details as appropriate until a new record for today's appointment is created.



Click *Use Record*. The main menu for the OtoWizard is now on your screen.

**OR**



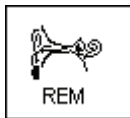
II. Running the OtoWizard under NOAH

Open *NOAH* from the desktop. Open the patient's folder (Client).



Click the measurement module ( $\Omega$ ) icon on the toolbar. The OtoWizard main menu appears on your screen.

**EXERCISE ONE: DEMONSTRATE THE HEARING LOSS TO THE PATIENT AND THIRD PARTY USING LIVE SPEECH MAPPING IN THE UNAIDED EAR**



Click *REM* on the main menu screen.



The first screen is *AUDIO*. The program automatically retrieves the patient's audiogram values in the patient's current record.

For the purposes of this exercise, manually enter the following audiogram values for *Right Ear, AC*:



20 at 250, 30 at 500, 40 at 1000, 50 at 2000 and 60 at 3000, 4000, 6000 and 8000Hz.



Click *UCL* and enter the following values:

100 at 250, 100 at 500, 95 at 1000, 95 at 2000, 90 at 3000, 90 at 4000, 6000 and 8000Hz.

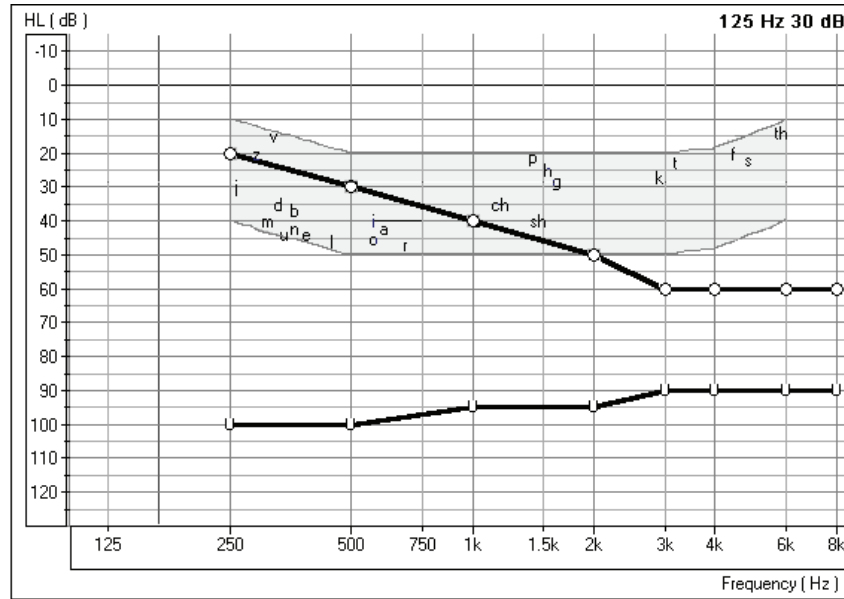


Click *Help* to read a description of the *AUDIO* screen. Follow the links for speech spectrum and speech sounds overlay.

Close the help file using the *X* icon.

Explain the Audiogram to the patient and third party.

Include an explanation of the speech spectrum, the normal dynamic range of hearing and the patient's reduced dynamic range due to the hearing loss and the reduced tolerance levels (UCLs).



Audio screen.

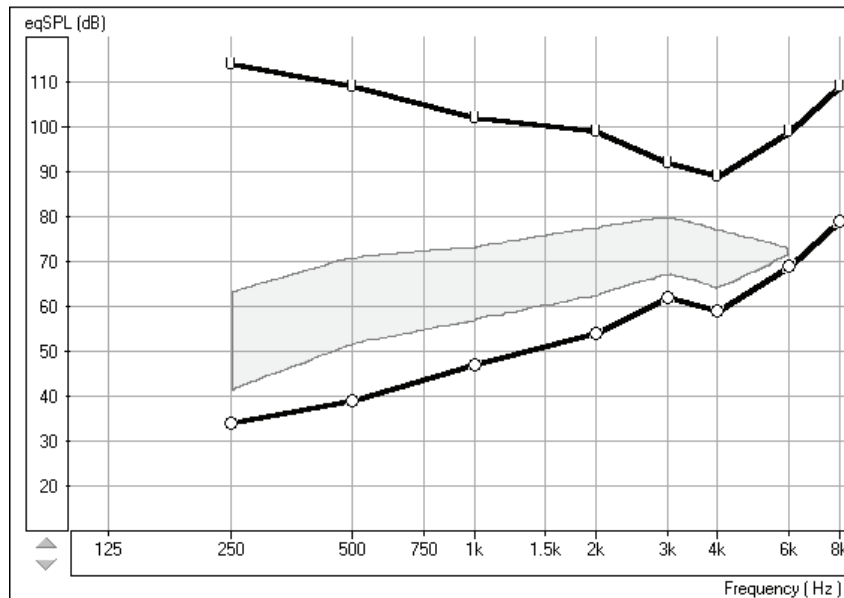


Click *Live Speech Mapping* on the taskbar.

Click *Help* and become familiar with the display and icons used in REAR and Live Speech Mapping. Read the link to Live Speech Mapping.



Close the help file using the *X* icon.



LSM display

Explain the display to the patient and third party. The display still shows the patient's hearing loss and tolerance levels, however this time the graph represents soft sounds at the bottom and very loud sounds at the top. Until sounds reach the hearing threshold levels, the patient cannot hear the sounds. When the sounds go higher than the U symbols, they become intolerable.

Explain the aided speech spectrum, which is the white shaded area. The peaks of normal conversation need to be at the top of this white area.



Perform an otoscopic inspection of the patient's ear canal. Use the Video Otoscope preview mode by clicking on the *camera* icon on the toolbar.



Click *Back* to return to the REAR screen.

Back

Insert the probe microphone into the patient's right ear canal.

#### UNAIDED LIVE SPEECH MAPPING



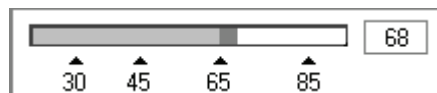
Click, *Right Ear*.

Position the patient facing you at a distance of 3 feet. Make sure the patient and third party can also see the monitor.



Click *Start* or press Enter on the keyboard.

Speak in a normal conversational level. Monitor the input level with the VU meter on the display.

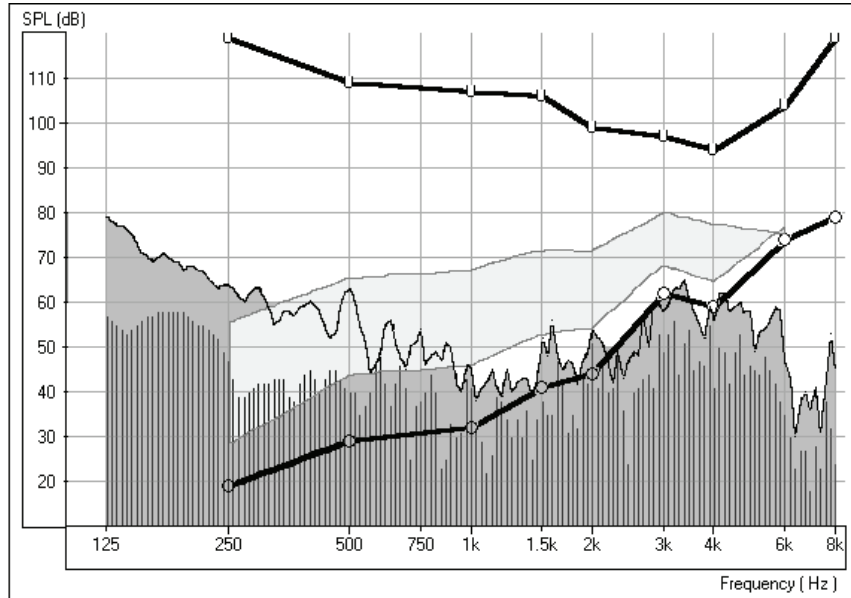


Monitor the dynamic Live Speech Map on the display and point out where your voice falls below the top of the speech spectrum, or in some moderate-severe cases, below threshold!

This is also a good time to demonstrate "pitch". Using a low and a high frequency tuning fork, you can further explain the distribution of pitch.

Position the third party facing the patient at a distance of 3 feet and have the third party speak in a normal conversational level.

Monitor the Live Speech Map and point out where important speech sounds are being missed.



Live Speech Map for unaided normal speech.



Click *Stop* or Esc on the keyboard.

The peak energy of the Live Speech Map recorded since you pressed Start is stored to the screen.



Point and click the mouse to the stored Live Speech curve. The curve will momentarily change to a white line. Click *Discard*. The curve is removed from the display.

USING THE RAINBOW PASSAGE

It is useful to present material which is representative of long term speech for Live Speech Mapping. The Rainbow Passage provides all of American English speech sounds as they would occur in everyday speech.

A printed laminated panel with the Rainbow Passage is provided with the OtoWizard. You will also find it in the Help files and at the end of this training guide.

Position the patient facing you at a distance of 3 feet.



Make sure the testing room is quiet.

Click *Start*.



Read the Rainbow Passage in your normal speaking voice. As soon as you have completed the Rainbow Passage, immediately click the *Stop* icon.

Look at the stored Live Speech Map curve on the display and provide feedback to the patient.

You can repeat this exercise with the third party speaking the Rainbow Passage.

These curves provide a good comparison to any aided Live Speech curve measured in the same manner.

**EXERCISE TWO: USE LIVE SPEECH MAPPING TO UPGRADE A PATIENT FROM LINEAR HEARING AIDS TO HIGH END PROGRAMMABLE HEARING INSTRUMENTS**

Aided Live Speech Mapping can be used to demonstrate the difference between the patient's current linear hearing aids and the performance of new high tech hearing instruments.

Perform the unaided demonstration described above in Exercise One.

The patient and third party should now have a good understanding of the hearing loss and the objective to have normal level speech at the top of the aided speech spectrum.

LIVE SPEECH MAPPING USING THE OLD LINEAR HEARING AID

With the probe microphone still in the ear canal, place the patient's hearing aid in their ear. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid. Ask the patient to adjust the hearing aid to a comfortable volume while you talk to him in a normal conversational voice.

Position the patient facing you at a distance of 3 feet.



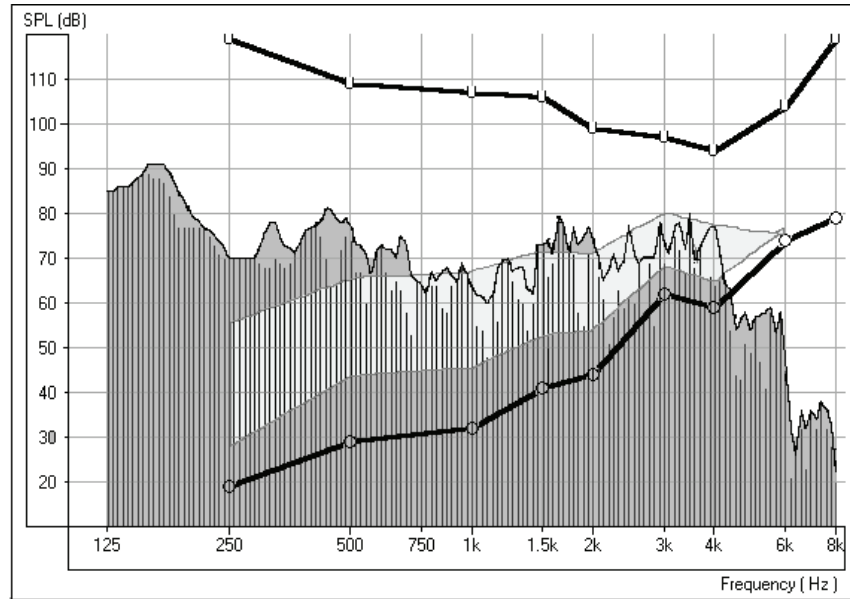
Select *Live Speech* on the control panel.



Click *Start* or press Enter on the keyboard.

Begin speaking to the patient at a normal conversational level. You can present the Rainbow passage, or read from any magazine article.

Unless there has been a significant change to the patient's hearing levels since the patient was fitted with the hearing aid, the linear hearing aid is probably doing a reasonable job of amplifying comfort level speech to the peak at the top of the aided speech spectrum.



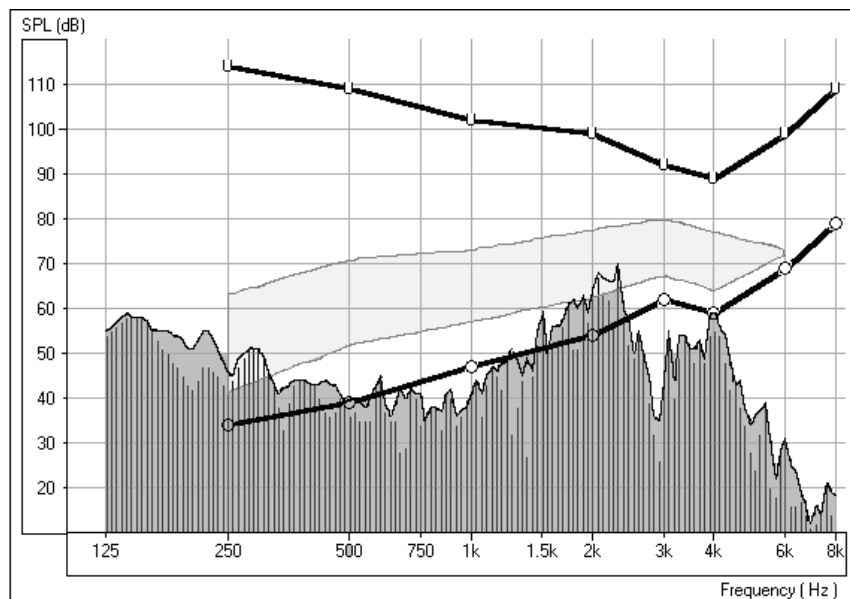
Comfort level Live Speech Map

Peaks of speech reach the top of the aided speech spectrum

Soft level speech

Lower your voice to a soft speaking level. You can do this by increasing your distance from the patient or dropping your voice level. **DO NOT ALLOW THE PATIENT TO ADJUST THE VOLUME ON THE HEARING AID.**

As you continue to speak at a soft level, the Live Speech Map immediately shows the poorer performance of the aid for soft sounds.

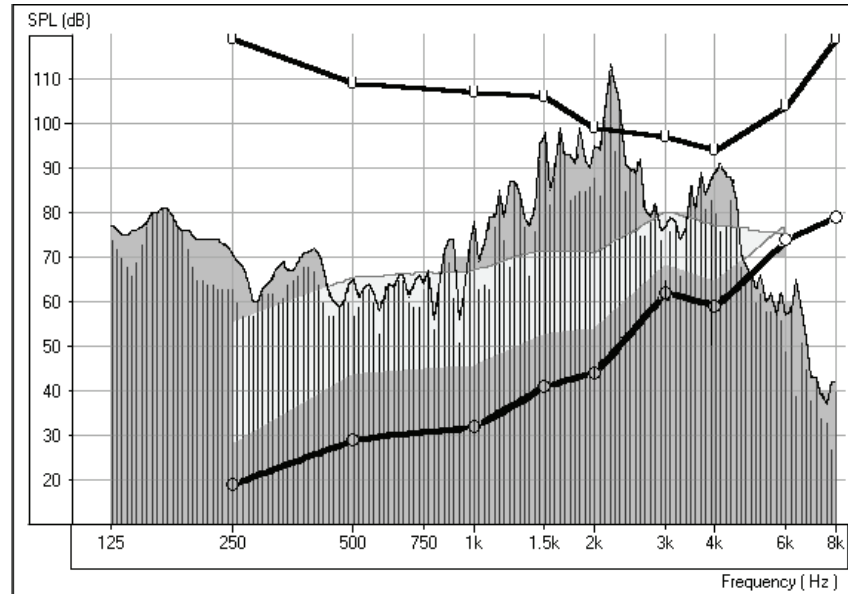


Soft input Live Speech Map

Mid and High frequencies drop to threshold and below threshold levels, becoming inaudible.

Loud level speech

Now, raise your voice to a loud level. Do this by coming very close to the patient or by shouting at 3 feet. DO NOT ALLOW THE PATIENT TO ADJUST THE VOLUME ON THE HEARING AID. The Live Speech Map shows any frequency at which tolerance limits are exceeded.

Loud input Live Speech Map

Tolerance limits exceeded with a loud input.



Press *Stop* to end this demonstration.

The demonstration with a soft and loud input level shows the patient the limitations of the current linear technology in adjusting for the different sounds in everyday listening situations.

Proceed to the next demonstration of "new" hearing aid technology.

LIVE SPEECH MAP USING NEW PROGRAMMABLE, WDRC OR DIGITAL HEARING AID

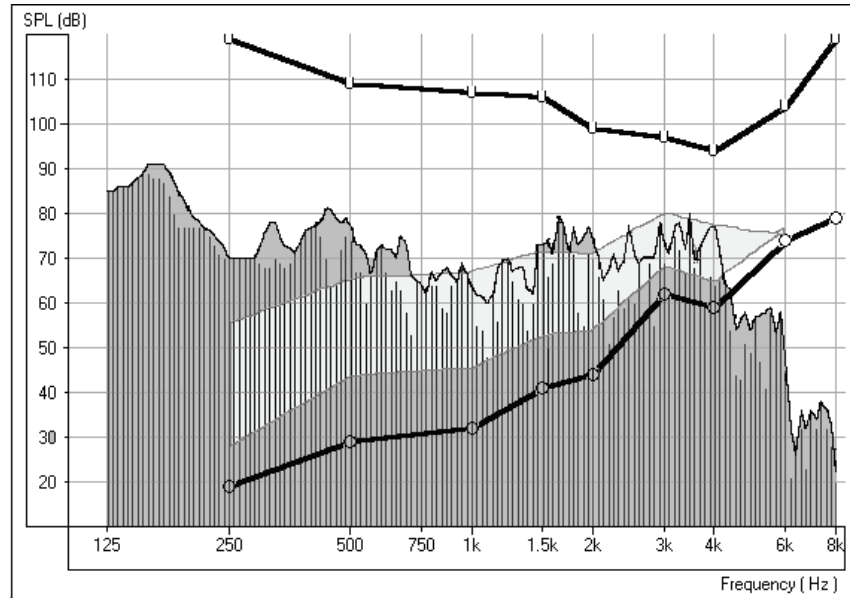
The procedure to follow to demonstrate high end technology in hearing instruments is the same as with the linear instrument, however this time use a pre-programmed stock hearing instrument of your choice. The high end wide dynamic range compression hearing instruments with programmability or digital hearing aids will perform best in this demonstration.

Pre-program the hearing instrument using the patient's audiogram information.

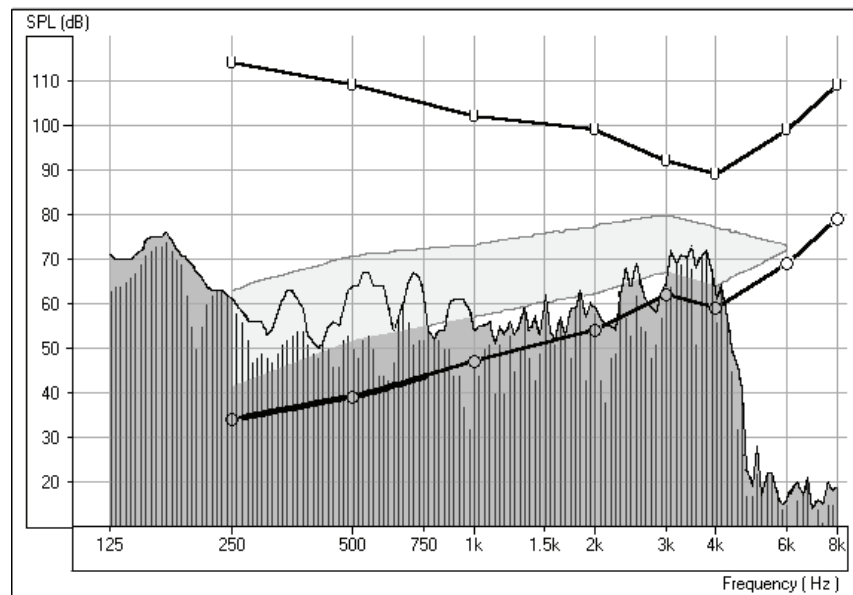
Note: The hearing instrument can be programmed from the fitting module in NOAH or from manufacturer specific stand alone programs installed on your OtoWizard. The exercises in Lesson Nine teach you how to program within NOAH. To use a stand alone fitting program, minimize the OtoWizard program and open the manufacturer's fitting software from the desktop. Program the aid and return to the REAR screen using **Alt + Tab** keys on the keyboard. Press and hold the Alt key down and press once on the Tab key to toggle between the opened programs.

With the stock hearing aid and probe microphone in place, adjust the aid to a comfortable volume for normal conversational level. The peaks of speech need to be at the top of the aided speech spectrum.

When the hearing instrument is set to a comfortable volume, demonstrate it's performance for normal, soft and loud speech. If you have programmed the instrument correctly, the Live Speech Map will remain within the boundaries of the patient's dynamic range of hearing for soft, comfort and loud input levels. This demonstrates the advanced technology in the hearing instrument as it is self adjusting to provide the correct amount of amplification for the listening environment, without the need for the patient to continually adjust a volume control.

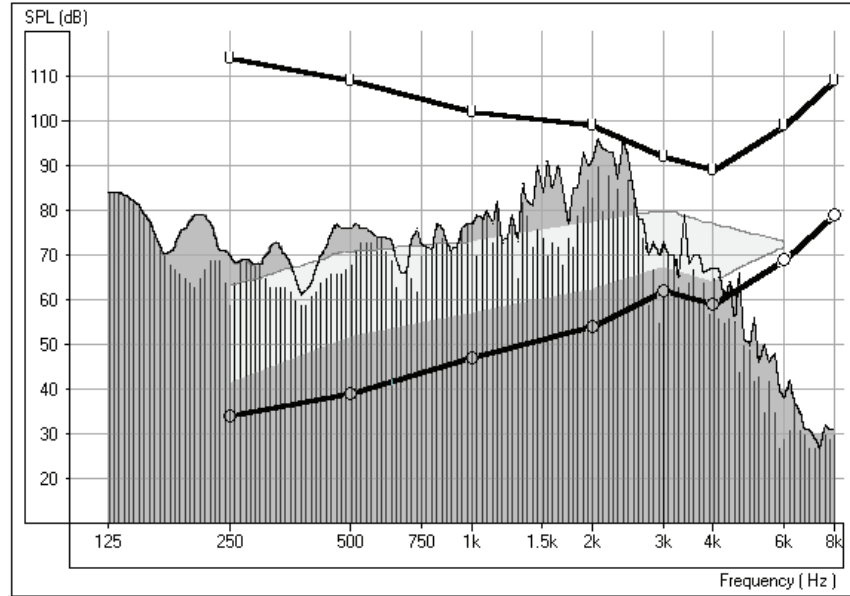


Good comfort level curve.



Good soft level curve





Good loud level curve

**EXERCISE THREE: DEMONSTRATE HIGH END TECHNOLOGY HEARING AIDS TO A NEW, UNAIDED PATIENT USING LIVE SPEECH MAPPING**

Live Speech Mapping provides a unique opportunity for the first time hearing aid user to experience and understand the benefits of quality hearing instruments. "Seeing" the benefits of high end hearing instruments is important in the patient's process of deciding which hearing instrument to invest in.

Required: Perform the unaided demonstration described in **Exercise One**.

The patient and third party should now have a good understanding of the hearing loss and the objective to have normal level speech at the top of the aided speech spectrum.

Pre-program your selected demonstration hearing instrument using the patient's audiogram values.

With the probe microphone in the ear, insert the stock demonstration hearing aid. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

Position the patient facing you at a distance of 3 feet.

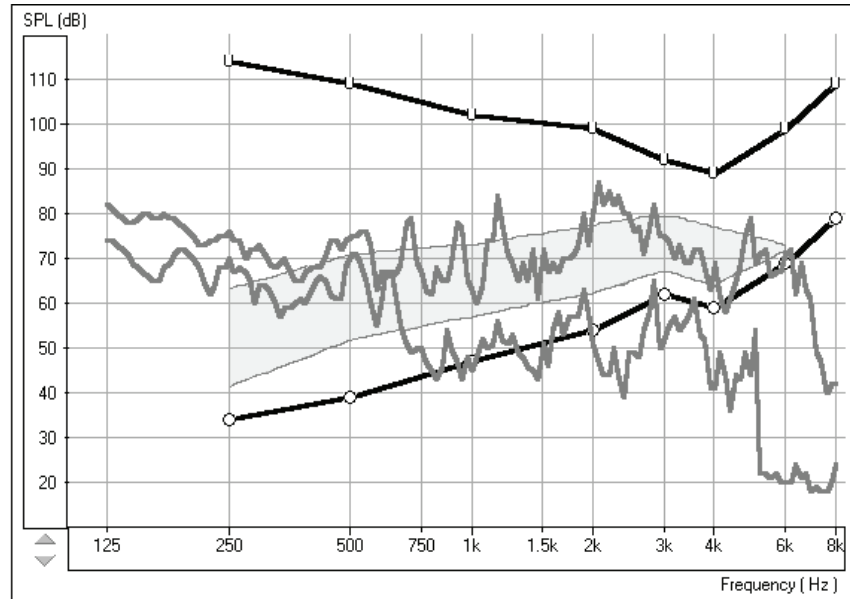


Click *Start* or press Enter on the keyboard.

Begin speaking to the patient at a normal conversational level (65-70dB). You can present the Rainbow passage, or read from any other magazine article.

Adjust the programming as necessary for the peaks of comfort level speech to be at the top of the aided speech spectrum.

Compare the aided and unaided curves.



Aided and Unaided Live Speech curves for comfort level speech.  
 The top curve is the aided result and the lower curve is the unaided result.

Continue with the Live Speech Mapping by demonstrating the instrument's performance for soft and loud speech. If you have programmed the instrument correctly, the Live Speech Map will remain within the boundaries of the patient's dynamic range of hearing for soft, comfort and loud input levels.

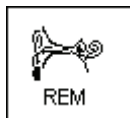


Press *Stop* to end this demonstration.

This demonstrates the advanced technology in the hearing instrument as it is self adjusting to provide the correct amount of amplification for the listening environment, without the need for the patient to continually adjust a volume control.

**EXERCISE FOUR: VERIFYING AND TROUBLESHOOTING HEARING INSTRUMENT FITTINGS USING LIVE SPEECH MAPPING**

The main objective of hearing instrument fittings is to make as much speech information available to the patient as possible. The verification procedure used when fitting hearing instruments **MUST** include real ear measurements using Live Speech.



Click *REM* on the main menu screen.

The first screen is **AUDIO**.

Review the Audiogram with the patient and third party. Include an explanation of the speech spectrum, the normal dynamic range of hearing and the patient's reduced dynamic range due to the hearing loss and the reduced tolerance levels (UCLs).



Click *Live Speech Mapping* on the taskbar.

Explain the display with the patient and third party. You will have performed an unaided demonstration at the hearing test appointment, so this is not the first time they have seen this screen.

If you did not perform an unaided demonstration of Live Speech Mapping at the first appointment, spend some time explaining this screen. The display still shows the patient's hearing loss and tolerance levels. The graph represents soft sounds at the bottom and very loud sounds at the top. Until sounds reach the hearing threshold levels, the patient cannot hear the sounds. When the sounds go higher than the U symbols, they become intolerable.

Make sure you have pre-programmed the new hearing instrument prior to this appointment.

Place the patient's new hearing instrument in the test ear. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

Position the patient facing you at a distance of 3 feet.



Click *Start* or press Enter on the keyboard.

Begin speaking to the patient at a normal conversational level (65-70dB). You can present the Rainbow passage, or read from any other magazine article.

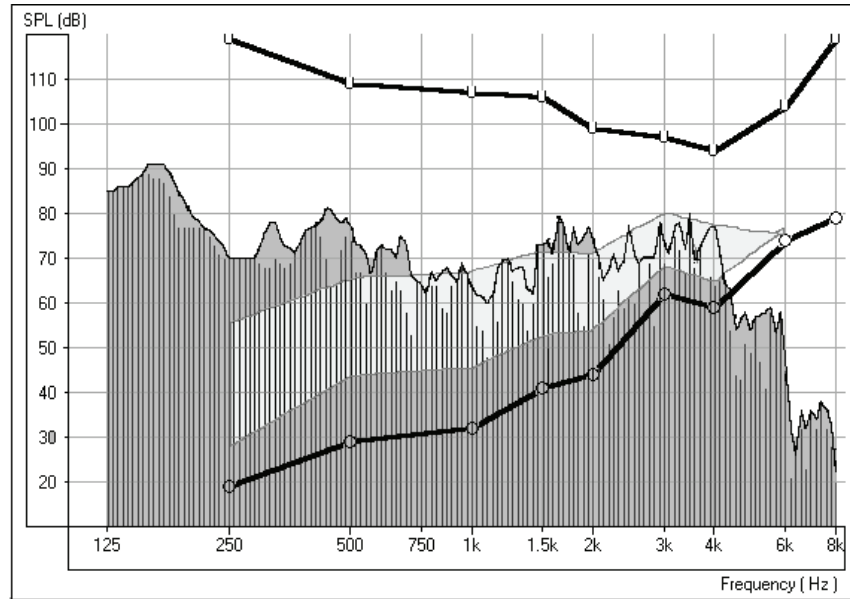
Adjust the programming as necessary for the peaks of comfort level speech to be at the top of the aided speech spectrum.

Note: The hearing instrument can be programmed from the fitting module in NOAH or from manufacturer specific stand alone programs installed on your OtoWizard. The exercises in Lesson Nine teach you how to program within NOAH. To use a stand alone fitting program, minimize the OtoWizard program and open the manufacturer's fitting software from the desktop. Program the aid and return to the LSM screen using **Alt + Tab** keys on the keyboard. Press and hold the Alt key down and press once on the Tab key to toggle between the opened programs.

For most fittings, you will concentrate on the mid to high frequency range. When the peaks of the Live Speech Map fall below the top of the aided speech spectrum, increase the gain at these frequencies.

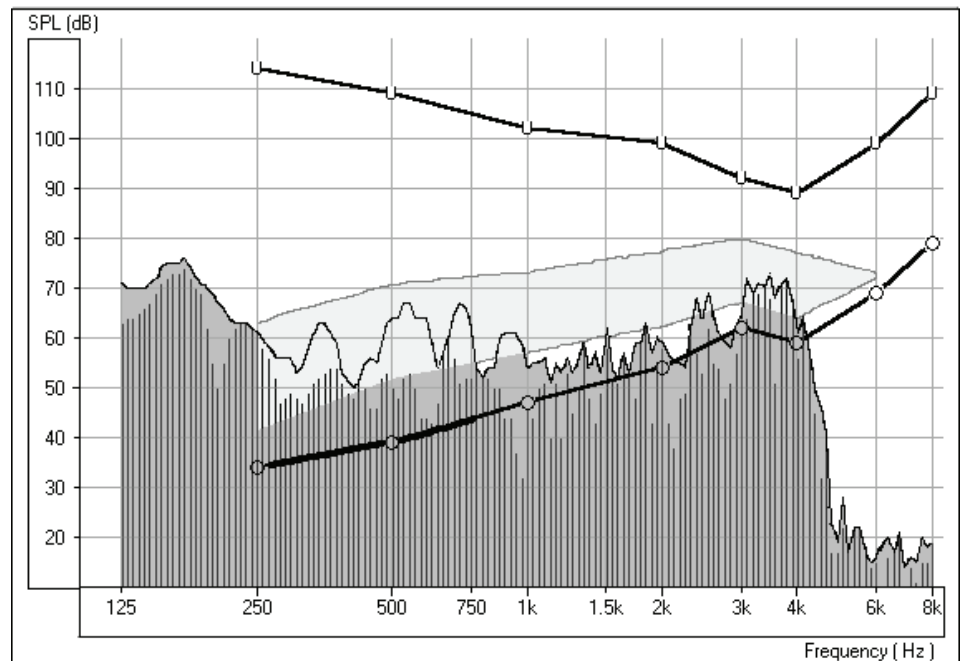
Many hearing instruments have at least two independent channels in which to adjust gain and an adjustable cross over frequency to set the width of these channels.

Make adjustments to these parameters until comfort level speech peaks at the top of the aided speech spectrum for as many frequencies as possible.

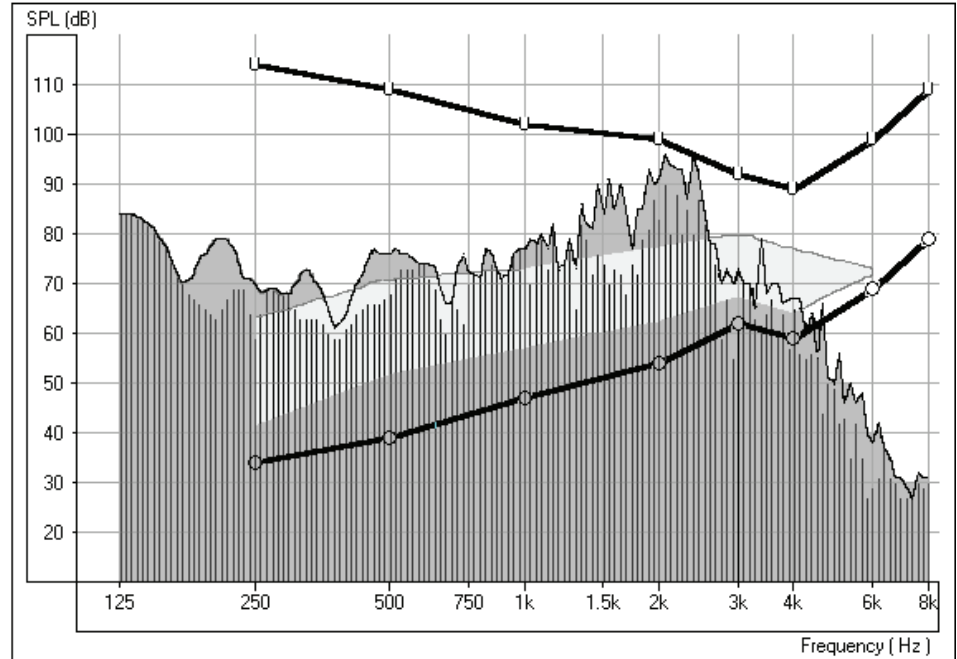


Normal conversational speech Live Speech Map

Continue with the Live Speech Mapping by demonstrating the instrument's performance for **soft** and **loud** speech. Aim to have as much of the soft speech audible for as many frequencies as possible. You may need to adjust the kneepoint(s) to allow sufficient gain for soft inputs. Make sure the UCL tolerance limits are never exceeded for a loud input. Make adjustments to the compression ratios or limiting to ensure the UCL's are never exceeded for loud inputs.



Good soft speech Live Speech Map



Good Loud speech Live Speech Map

If you have programmed the instrument correctly, the Live Speech Map will remain within the boundaries of the patient's dynamic range of hearing for soft, comfort and loud input levels.

#### TROUBLESHOOTING FITTINGS

One of the biggest challenges faced in hearing instrument fittings is "feedback". Live Speech Mapping is a unique and effective approach to dealing with feedback.

#### **Feedback**

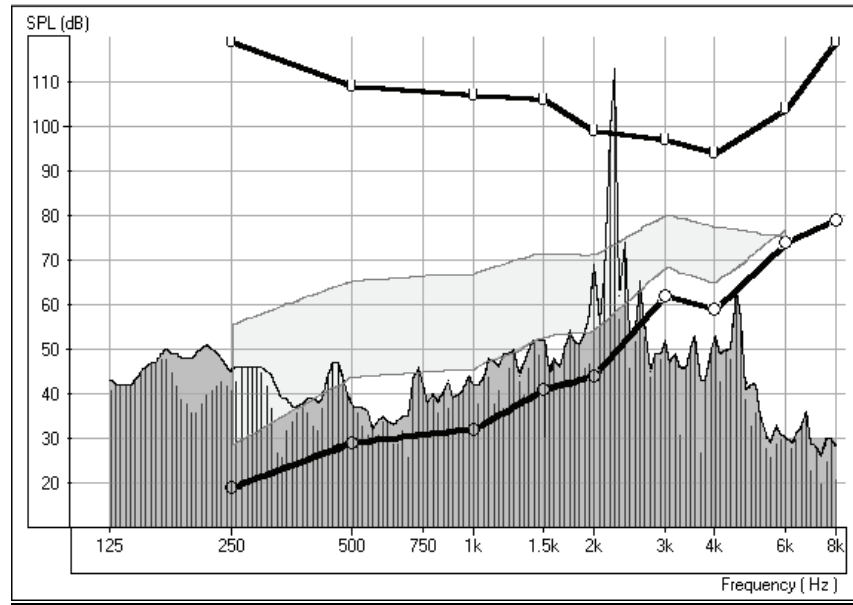
When a hearing instrument is in "feedback", it adds distortion and is a source of annoyance to the wearer and others who can hear it. When you are performing Live Speech Mapping, you can monitor the curve on the screen for the presence of feedback. It is possible to "see" feedback before it is audible to you.

#### What does feedback "look" like?

Look for a "spike" in the Live Speech curve in the high frequencies.

You may see one big spike in the response, in addition to other smaller spikes at higher frequencies than the big spike. The big spike represents the fundamental frequency of the feedback and the smaller spikes are harmonics of this fundamental.

The following diagram illustrates feedback with a fundamental peak frequency at 2200Hz.



Feedback at 2200Hz

#### How to eliminate feedback?

Firstly, check that the hearing instrument is properly inserted in the patient's ear.

Make sure the overall volume of the hearing instrument is set to the patient's preferred listening level for normal conversation.

Adjust the gain for the fundamental frequency of the feedback. This is where the spike is biggest.

Make sure these adjustments to the hearing instrument have been effective in eliminating the feedback by repeating the Live Speech Mapping curve.

When feedback is removed, repeat the Live Speech verification procedure to be sure you still have adequate gain for comfort and soft speech.

## LESSON EIGHT

### Operating the OtoWizard from within NOAH

There are two ways of running the OtoWizard software. The first is as a stand-alone program from the desktop. The second is to run the OtoWizard within NOAH.

The advantage of running the OtoWizard from within NOAH is the efficiency of performing "real time" real ear measurements while making programming changes to the hearing instrument on the same screen.

When you run the OtoWizard from within NOAH, the client records are stored in the NOAH database. As a safeguard, the OtoWizard is also storing the records to the OtoWizard patient database, hidden in the background. This ensures you will still have the patient records if NOAH fails or a new database platform replaces NOAH.

Remember to be consistent in the manner in which you run the OtoWizard in your office.

This lesson shows you how to run the OtoWizard from within NOAH.

### EXERCISES

#### EXERCISE ONE: CREATE A NEW CLIENT

#### EXERCISE TWO: MANUALLY ENTER AN AUDIOGRAM

#### EXERCISE THREE: "REAL TIME" REAL EAR MEASUREMENTS (REM) WHILE SIMULTANEOUSLY PROGRAMMING HEARING INSTRUMENTS.

#### EXERCISE FOUR: PERFORMING AUDIOMETRY FROM WITHIN NOAH

##### Preparation for Exercise One

You need to load your own copy of NOAH to the OtoWizard, since you are the licensed user of that software.

The OtoWizard module must be installed in NOAH. Follow the instructions provided with the OtoWizard software to install the module.

To configure the NOAH toolbar, perform the following:

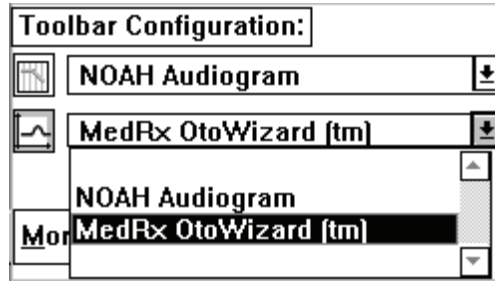


Open *NOAH* from the desktop.

Point the mouse to *Setup*, on the toolbar and select *Preferences* from the dropdown menu. **Setup | Preferences.**

Under the heading *Toolbar Configuration*, locate the measurement icon.

Click the down arrow icon and select *MedRx OtoWizard™*.



Click *OK*.

This assigns the measurement icon to the OtoWizard.

**EXERCISE ONE: CREATE A NEW CLIENT**



Open *NOAH* from the desktop.



Click *Client Module*.

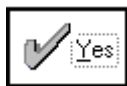


Click *New Client*.

Enter a first and last name.



Click the check mark ✓ on the toolbar.



Click *Yes* to save the new client in the database.

The new client's name appears on the NOAH toolbar.

**EXERCISE TWO: MANUALLY ENTER AN AUDIOGRAM**

For the purposes of this lesson, an audiogram will be entered manually in NOAH.

In practice, if this is a new client without an audiogram, you will need to perform Audiometry with the OtoWizard. Instructions for performing Audiometry from NOAH are provided in Exercise Four of this Lesson.



Click *NOAH Audiogram* on the toolbar.



Enter the following audiogram values for the right and left ear:

Air conduction:

20 at 250, 30 at 500, 40 at 1000, 50 at 2000 and 60 at 3000, 4000, 6000 and 8000Hz.

UCL values:

100 at 250, 100 at 500, 95 at 1000, 95 at 2000, 90 at 3000, 90 at 4000,6000 and 8000Hz.



Click the check mark ✓ on the toolbar.



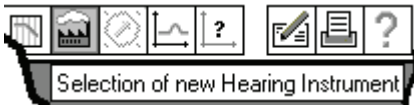
Click *Yes* to save the new audiometry in the database.

The New Audiogram appears under the Session summary with a date and time stamp.

**EXERCISE THREE: "REAL TIME" REAL EAR MEASUREMENTS (REM) WHILE SIMULTANEOUSLY PROGRAMMING HEARING INSTRUMENTS**

Setup

Pre-program the hearing instrument using the patient's audiometric data as appropriate. Make sure the instruments are connected to the HIPRO cables.

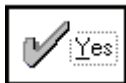


Click *Selection of new Hearing Instrument* on the toolbar.

Select the manufacturer's fitting module and pre-program the hearing instrument.



Save the initial programming in the fitting module.



Click *Yes* to save and close the fitting module.

Perform an otoscopic inspection of the patient's ear canal.



Click the measurement module (Ω) icon on the toolbar.

The OtoWizard main menu screen appears.



Click *Video*.



Click *Frame*.

Frame

Examine both ears.

To store images to the database, click *Frame* again for each image.



Click *Back* to return to the OtoWizard main menu screen.

Insert the probe microphone into the patient's right ear canal.

With the probe microphone still in the ear canal, insert the patient's hearing aid. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

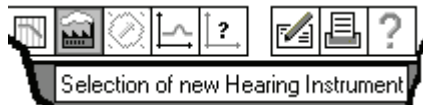
Position the patient facing the box loudspeaker at a distance of no more than 3 feet.

"Real time" REM while simultaneously programming the hearing instrument



Click *NOAH REM* icon on the OtoWizard main menu screen.

The REM REAR screen appears on the display in the lower left corner. The client's audiogram data has automatically been imported to the REAR screen.



Click *Select a new Hearing Instrument* icon on the toolbar.

All the icons for the hearing aid manufacturer's fitting modules installed on the system will appear on the screen.

Click the *NOAH* icon if you do not have any fitting modules installed or the manufacturer of the hearing instrument you are using for this exercise.

You now have the fitting software on the display, with the OtoWizard REM REAR screen "on-top".

It is now possible to make programming changes to the hearing instrument from the fitting software, while simultaneously monitoring the outcome on the REM REAR display.

NOTE: The "active" window is identified by a blue toolbar. An "inactive" window is identified by a gray toolbar. To make selections in either the fitting or REM REAR screen, make sure the window has a blue toolbar. To make a window "active", simply click anywhere on that window.

Turn a stimulus ON

On the REM REAR toolbar, click **Stimulus | Speech Weighted Noise**.

Click **File | Start MSC** (Manual Signal Control) or press Ctrl + Enter on the keyboard.

The OtoWizard produces a continuous SWN signal from the box speaker.

Click anywhere on the fitting module screen.

It is now possible to make changes to the hearing aid programming while monitoring the REAR curve with the continuous SWN input signal.

#### COMFORT LEVEL

Make initial adjustments for a comfort level (65dB) input.

Remember what you learned in Lesson Six. The target for a 65dB SWN input level is to place the REAR curve halfway between the patient's air conduction and UCL at each frequency.

When you are satisfied with the hearing instrument settings, click on the REM REAR window to make it active, and select **File | Stop** or press Esc on the keyboard. This turns the Manual Signal Control (MSC) off.

When you are in the MSC mode, the data curve is not stored to the screen permanently.

To store a curve for 65dB SWN, select **File | Start** or press Enter on the keyboard. A measurement is made and stored to the REM REAR display.

#### LOUD LEVEL MEASUREMENT

Follow the same procedure for a 90dB input level to program the hearing instrument for loud input levels.

Click **File | Start MSC** or press Ctrl + Enter on the keyboard.

The OtoWizard produces a continuous SWN signal from the box speaker.

Increase the attenuator from 65 to 90 in 5dB steps. Press Stop or Esc on the keyboard as soon as the patient's UCLs are exceeded at any frequency.

Make programming changes using the fitting software to adjust the compression or limiting for loud sounds.

Repeat until the curve for a 90dB input level below the patient's UCLs at all frequencies.

#### SOFT LEVEL MEASUREMENT

Click **File | Start MSC** or press Ctrl + Enter on the keyboard.

The OtoWizard produces a continuous SWN signal from the box speaker.

Decrease the attenuator from 65 to 50 in 5dB steps

Aim to have as many frequencies as possible "audible" for the 50dB input level.

Store curves for the 90 and 50dB input levels. To store each curve, set the level on the attenuator to either 90 or 50 dB and press Enter on the keyboard. A measurement is made and stored to the REM REAR display.

LIVE SPEECH MAPPING

Consolidate the fitting by using **Live Speech Mapping**.

**Lv. Sp.**

To select Live Speech mode, click the Live Speech Mapping *Lv.Sp.* icon on the taskbar or go to REAR on the toolbar, click on Stimulus and select Live Speech (No Stimulus). **Stimulus | Live Speech (No Stimulus)**.

The Live Speech Mapping mode is now activated.

Click the *green* and *red* circle icons on the taskbar to start and stop live speech sampling.

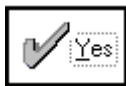
The peaks of speech for normal conversational speech should reach the top of the aided speech spectrum on the REM REAR display. Lesson Seven, exercise Four details the procedure for hearing instrument fitting using Live Speech Mapping.

**Saving the Fitting and REM REAR data**



When you are satisfied with the hearing instrument fitting, you need to save the fitting settings and the REAR curves.

Save and close the NOAH fitting module first.



Click *Yes* to save the fitting module.



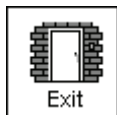
When the fitting module is closed, click the measurement icon on the NOAH toolbar.

This opens the OtoWizard REMREAR screen to full size.

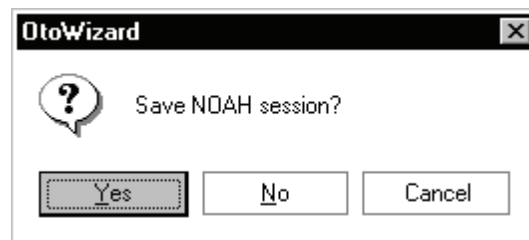


Back

To save the NOAH session, click *Back*.



Click *Exit*.



Click *Yes* to save the NOAH session.

Complete the record questionnaire, summary and comments fields as needed.

**Finish**

Click *Finish*.

The NOAH Sessions summary now lists a Fitting record and MedRx REM record.

VIEWING SAVED SESSIONS IN THE NOAH DATABASE

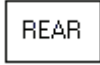


To view the REM data, click on the MedRx REM session from the Sessions list in NOAH.



Click the *measurement icon*  $\Omega$  on the NOAH toolbar.

Click *REM*.



Click *REAR*.

The stored curves are automatically displayed on the REAR screen.

**EXERCISE FOUR: PERFORMING AUDIOMETRY FROM WITHIN NOAH**



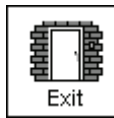
To access Audiometry, click the measurement icon on the NOAH toolbar and the OtoWizard main menu screen appears.



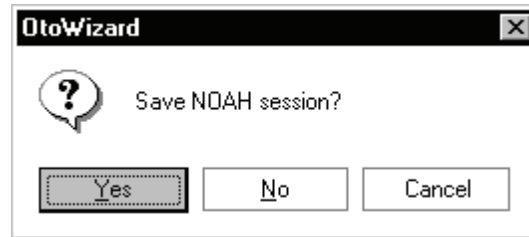
Click *Audiometry* and perform all necessary testing. Lesson Three covers Audiometry.



When testing is complete, click *Back* to return to the main menu screen.



Click *Exit*.



Click *Yes* to save the session to NOAH.

Complete the patient record questionnaire, summary and comments sections as needed.



Click *Finish*.

The Audiometry data is stored in NOAH and can be viewed both in the NOAH Audiometry module and in the OtoWizard module.

## LESSON NINE

### Occlusion Effect

One of the biggest concerns we have in hearing instrument fittings is dealing with the common complaints of: "I sound like I am in a barrel"; "I don't like the sound of my own voice"; "My own voice seems too loud"; "I feel blocked up".

Our knee-jerk reaction upon hearing these complaints is to quickly grab the offending hearing instrument, run to the back room and start modifying the aid by grinding on it, or by decreasing low frequency gain. Sometimes this works. Why doesn't it work all the time?

In order to treat these complaints effectively, it is necessary to have a good understanding of the cause of the complaint. Is the cause due to the Occlusion Effect? Or is the complaint due to an incorrect frequency response in the aid?

#### WHAT IS OCCLUSION EFFECT?

The definition of Occlusion Effect is the build up of self-generated energy (patient's own voice) in the ear canal, due to the coupling of the hearing aid to the patient's ear.

Basically, by plugging up the ear canal with a hearing instrument, we trap some of the low frequency energy created when the patient speaks. This low frequency energy is transmitted through the skull to the external ear. When the ear canal is not blocked, this energy escapes down the ear canal and is not heard.

### EXERCISES

#### EXERCISE ONE: OCCLUSION EFFECT DEMONSTRATION

#### EXERCISE TWO: MEASURING THE OCCLUSION EFFECT

#### What is Occlusion Effect?

The Occlusion Effect is a specialized, yet easy to perform test, to *objectively* assess clients who report discomfort with their own voice. Some clients report they seem like they are "speaking in a barrel" or "feel blocked up". These are signs of a build up of low frequency energy in the ear canal. However, occlusion effect may not be the cause in all cases.

The amount of trapped low frequency energy in the ear canal can be measured objectively in the Occlusion Effect function in the Real Ear Measurement (REM) menu.

To measure the Occlusion Effect, we use the patient's own voice as the stimulus and the real ear probe microphone positioned at the eardrum. The patient vocalizes "eeeeee" without the hearing aid in the ear, performing the Open Ear Spectrum measure. This measure is then compared to the same vocalized input with the hearing aid in the ear, but turned off. The resulting difference is the Occlusion Effect.

**EXERCISE ONE: OCCLUSION EFFECT DEMONSTRATION**

With both hands cupping each side of your chin, along your jawbone, rest your elbows on a hard surface.

Say the sound "Shhhhhh".

Now say the sound "Eeeeeeeee".

Which of these two sounds do you "feel" as vibration on your hands?

The "eeeeee" sound will generate more vibration.

This time, place the tip of your index finger in each ear canal to close the canal. Make the same sounds "Shhhh" and "Eeeee".

Which is louder?

The "eeeeee" sound will be louder.

You have just experienced the Occlusion Effect.

**EXERCISE TWO: MEASURING THE OCCLUSION EFFECT**

Click *REM* on the main menu screen for the OtoWizard.



Click *O/E* on the taskbar.

About the display: The grid on the left of the display has a dB SPL vertical axis and a Frequency in Hertz horizontal axis. The only icons on the control panel are for test ear.



Click *Right Ear*.

The first step is to perform an Open Ear Spectrum measurement, which will act as a baseline for this patient's normal voice level in the ear canal.



Click the *camera* icon and perform an otoscopic exam of the ear canal.



Back

Click *Back* to return to the Occlusion Effect screen.

**OPEN EAR MEASUREMENT**

Insert the probe microphone to within 6mm of the eardrum.

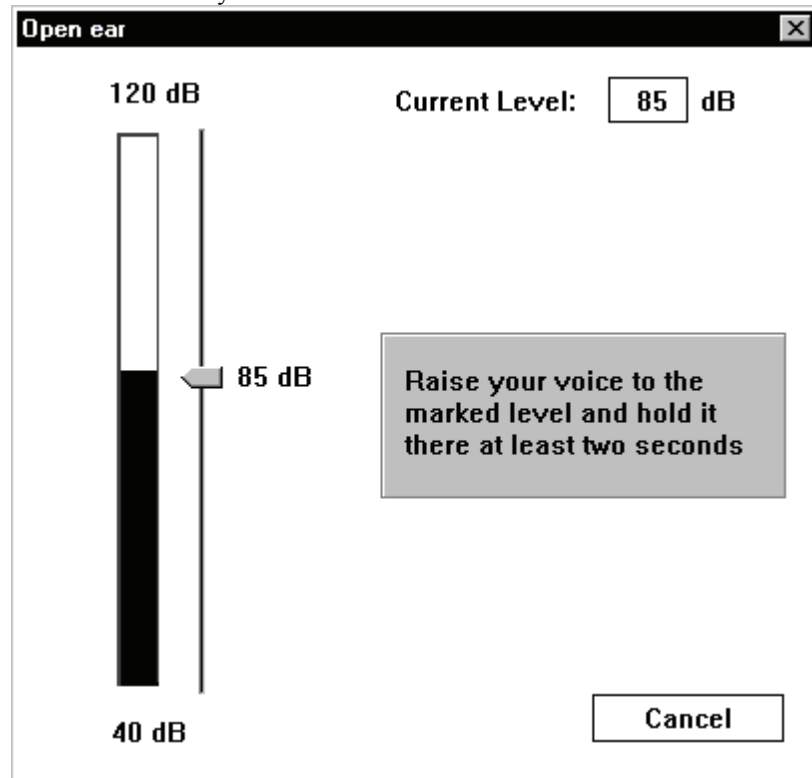


Click *START*.

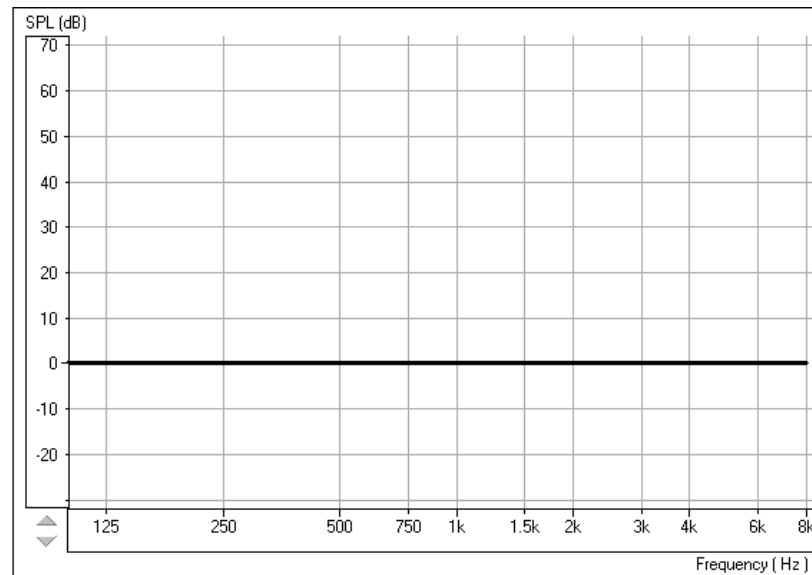
A vertical VU meter appears on the screen.

Instruct the client to make the sound "eeeeee" and hold this sound constant at the target level indicated by the arrow. The default level is 85dB. When the appropriate

level is reached and sustained for two seconds, the system stores the measure to the screen automatically.



When the Open Ear measurement is stored, you will see a colored line at zero dB on the display to indicate the program has "normalized" the client's Open Ear Spectrum for comparison to the next "occluded" measurement.





**Tip:** If the patient has difficulty holding their voice level to 85dB, click the *Arrow* icon on the Volume Level meter and drag up or down to the desired level. This is only required for patients with very soft or loud voices.

#### OCCLUDED EAR MEASUREMENT.

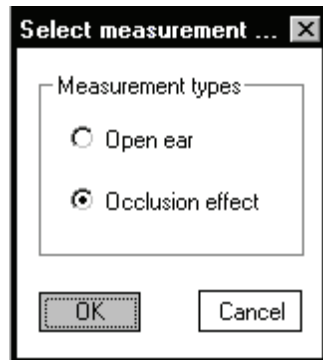
Insert the patient's hearing aid, making sure you do not advance the probe tube further down the ear canal. The hearing instrument is turned OFF and the battery door is closed.



Click *Start*.

A text box message appears and requests you to confirm you are performing the Occluded Ear measurement or allowing you to repeat the Open Ear Spectrum measure. Only repeat the open ear measure if you are dissatisfied with the first Open Ear Spectrum measurement.

The program defaults to selecting the Occlusion Effect option.

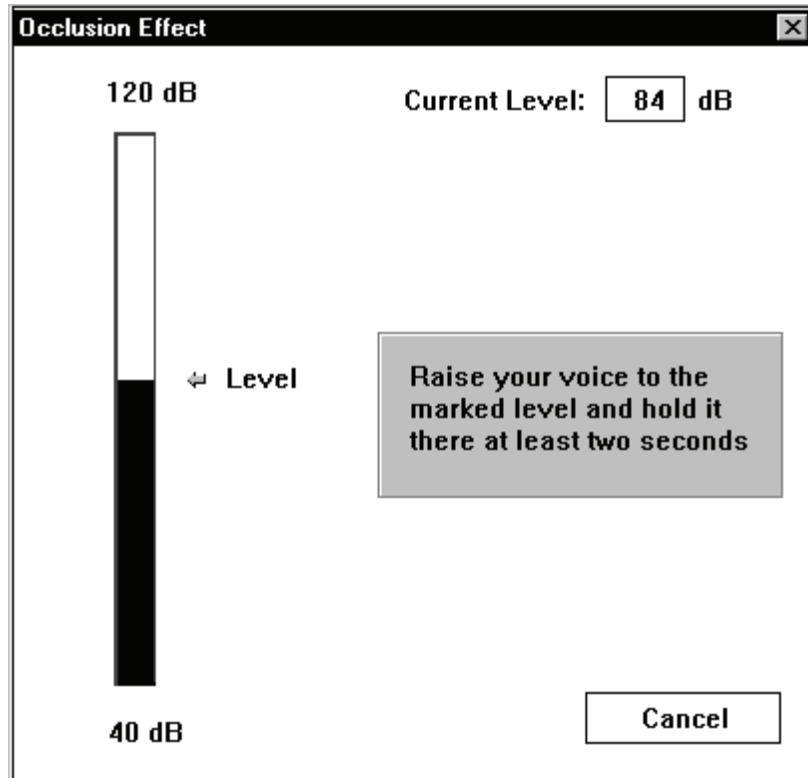


Click *OK*.

The Volume Level meter appears on the screen to show the "target" voice level for the patient to reach when saying "eeeeee".

Instruct the patient to say "eeeeeee" while you point to this "target" level until the measurement is captured.

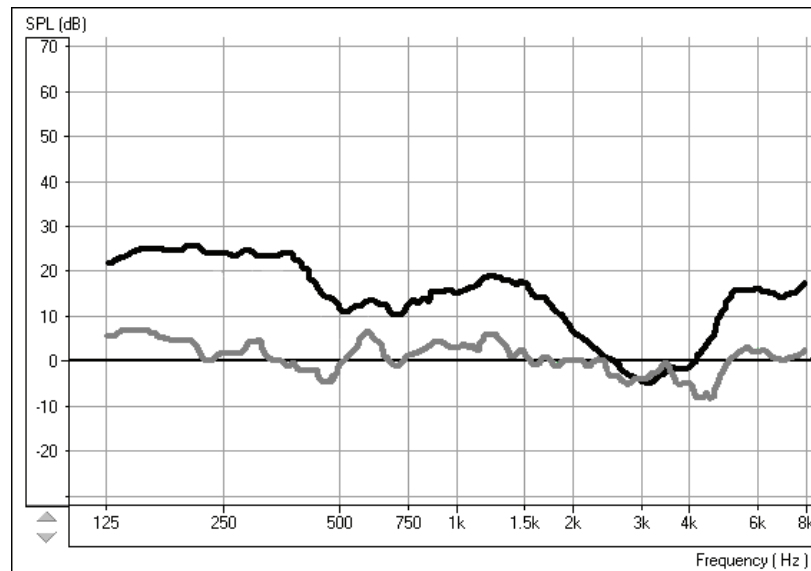
The Occlusion Effect curve is plotted to the screen automatically after the patient has sustained an "eeeeeeee" at the target level for one second.



Target Level for Occluded measurement

**Interpreting the results**

Usually, a measure of 20 dB SPL or more in the low frequencies is noticeable occlusion effect to the client and indicates a need to modify the hearing instrument fitting to reduce this effect. Subsequent measures of the Occlusion Effect can reveal if such modifications have been effective in reducing the amount of occlusion.



The top curve indicates significant occlusion effect. The lower curve is a close match to the normalized zero line and does not indicate significant occlusion effect.

Suggested modifications to the hearing instrument include:

Increasing the insertion depth  
Tapering the canal tip of a CIC  
Maximizing the venting, while considering the risk of feedback.

A key to good customer service is to **always** be prepared to take a new, deep impression.

If you are unable to reduce the amount of occlusion effect by making physical changes to the hearing instrument, consider increasing the low frequency gain of the instrument. This additional low frequency gain may "mask" the amount of trapped energy in the ear canal, making it less noticeable to the patient when they speak.

What can you do if you do not measure any significant occlusion effect?

No amount of modifications to the shell or acoustic coupling of the hearing instrument to the patient's ear canal will change the patient's complaints about their own voice if you do not measure any occlusion effect.

The cause of the patient's complaints is more likely to be an inappropriate frequency response or other acoustic amplification characteristic of the hearing instrument.

Return to the *REAR* function in REM and make adjustments to the frequency response while monitoring the patient's subjective response in regard to the pleasantness of their own voice. Monitor the patient's own voice using Live Speech Mapping.

## LESSON TEN

### Loudness Scaling

Loudness Scaling provides patient specific gain and compression targets. These targets are a great assistance to us when fitting patient's who have significant recruitment or who are "sound addicts".

This procedure assumes you are aiming for normal loudness restoration for your patients.

#### Reasons to do Loudness Scaling

When a patient remarks that they can never get the hearing aid volume set at a comfortable level for conversation without it becoming uncomfortably loud for slightly raised voices.

When a patient remarks that when they adjust the hearing aid volume to hear normal conversation, they miss all soft sounds.

### EXERCISES

#### EXERCISE ONE: PERFORMING LOUDNESS SCALING

#### EXERCISE TWO: USING LOUDNESS SCALING TARGETS IN REAL EAR MEASUREMENTS

#### EXERCISE THREE: USING LOUDNESS SCALING INPUT/OUTPUT TARGET CURVES TO SET GAIN AND COMPRESSION

#### EXERCISE FOUR: SOFTWARE CUSTOMIZING OPTIONS FOR LOUDNESS SCALING

#### EXERCISE ONE: PERFORMING LOUDNESS SCALING

##### Setup for Loudness Scaling

Ensure that the system is calibrated, the appropriate output transducer is connected (inserts or Free Field loudspeaker) and the background noise is controlled in the test environment as defined in the ANSI S3.6 (1989) standard prior to performing this task.

Details for the calibration of the inserts used in Loudness Scaling are provided in General Operations and Maintenance.



Patient

#### Open a Patient folder

Click *Patient*.

Click on a patient's name from the list in your database.



Click *Open*.



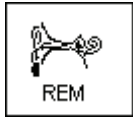
Click *New Record*.



Enter details as appropriate until a new record for today's appointment is created.

Click *Use Record*. The main menu for the OtoWizard is now on your screen.

Manually enter Audiogram values for this exercise



Click *REM* on the main menu screen.

Manually enter the following *Air Conduction* values for the *Right Ear*.

30dB at 500Hz and 60dB at 3000Hz.

For the purpose of this lesson, we will only use these two frequencies.



Click *Back*, to return to the main menu screen.

Perform Loudness Scaling



Click the *Loudness Scaling* icon on the main menu screen.



Click the *Help* icon for an explanation of the icons used in Loudness Scaling.

Follow the links to other Loudness Scaling topics for more background as needed.

Close the Help topic from the *X* icon.

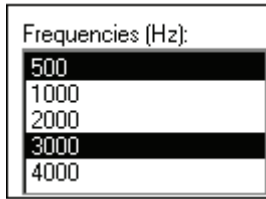
The program gives you a choice of scaling protocols: IHAFF (Independent Hearing Aid Fitting Forum) and RELS (Real Ear Loudness Scaling). In most cases, the ascending IHAFF protocol is recommended. The random RELS protocol requires a cognitively alert and cooperative patient and takes more time to administer.



The first step in loudness scaling is to obtain the patient's subjective judgment of sound levels in the range of "very soft" to "uncomfortably loud".

Setup

Select *Right Ear*, *AC*, *IHAFF* and *Tone* on the control panel. (these are the normal defaults for Loudness Scaling)



Select 500 and 3000Hz as the test frequencies. It is advisable to get data for at least one low and one high frequency. The selected test frequencies are highlighted in blue on the screen.

Position the patient in front of the monitor to ensure good visibility of the display. For patients with poor vision at this distance, a large-print panel of the display screen can be held by the patient. This panel is provided with the OtoWizard.

Explain the task to the patient and familiarize the patient with the smiley faces and response categories. It is important the patient understands the purpose of this task and is capable of performing the response as required. The dialogue below may be useful in helping you to explain the test.

“The purpose of this task is for you to tell me how loud you judge different sounds to be. There are no right or wrong answers. You will hear a beeping sound when you see the light flashing on the screen. Imagine you are listening to the TV at that volume. Choose one of the categories on the screen that best describes how loud you judge the sound to be. Remember, “Uncomfortably Loud” is louder than you would ever listen to a sound for more than a few seconds.”

Review each response category and corresponding 'face' icons.



Perform an otoscopic inspection of the patient's ear canal. Use the Video Otoscope preview mode by clicking on the *camera* icon on the toolbar.



Back

Click the *Back* icon to return to the Scaling screen.



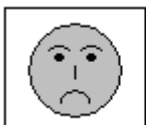
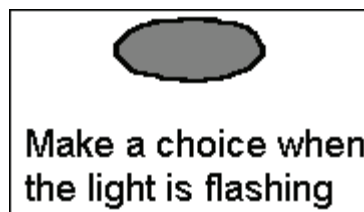
Place the insert earphones in the patient's ears.

Click *START*.

The starting test level is automatically determined from the patient's audiogram values. The start test level is 5dB above threshold and is converted to dBSPL.

The first test frequency is the lowest frequency selected in setup. In this case, 500Hz is tested first.

The icon at the top left of the display will flash on and off to indicate a signal is being presented and the patient is required to respond.



**Very soft**

To record a patient's response, whether given by pointing to the appropriate loudness category on the screen or hand held panel or

verbalizing a response, click the mouse on the corresponding *smiley face* icon on the screen. Expect the first response to be "very soft".

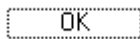
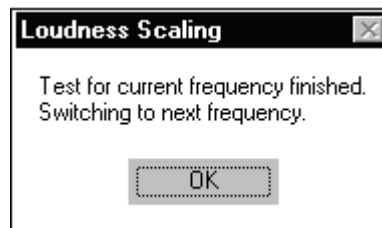
Each time a response is recorded, the test tone steps up 5 dB automatically and continues to pulse until the next response is recorded.

The legend in the lower left corner tells you the current test frequency and level.

Frequency (Hz):	<input type="text" value="500"/>
Level (dB):	<input type="text" value="54"/>

Each response is to be recorded in the same manner until "uncomfortably loud" is recorded. The test tone is immediately turned off to protect the patient from unnecessary exposure to this level.

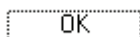
A message appears on the screen to inform you that you have tested the first frequency and when you select OK, the next frequency will be tested. This gives you an opportunity to inform the patient to listen for a new tone.



Select *OK*.

The system begins testing at 3000Hz, once again starting 5dB above the patient's threshold.

When "uncomfortably loud" is recorded, the program lets you know the test is complete.



Click *OK*.

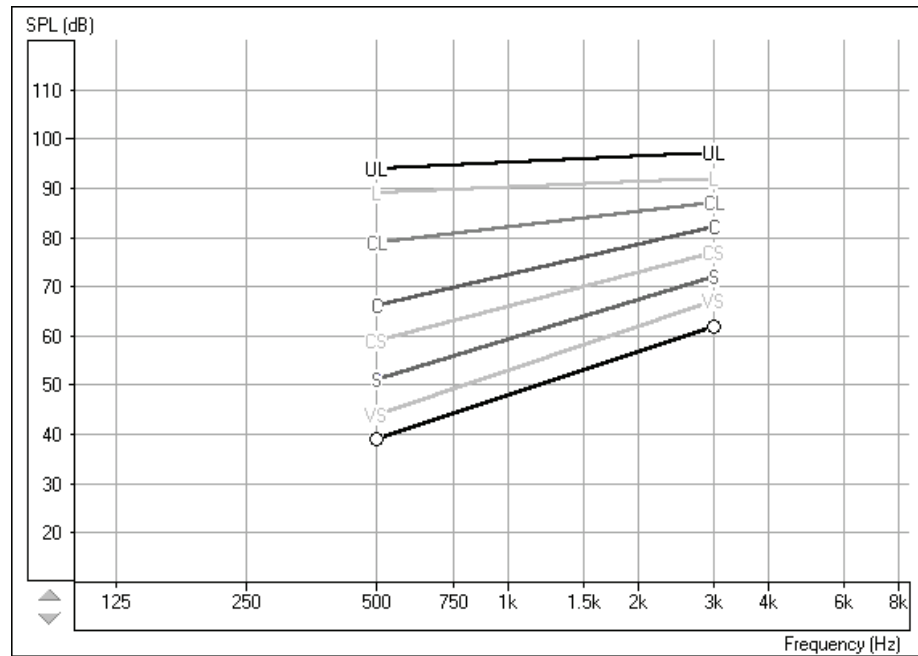
VIEW THE LOUDNESS SCALING DATA

SPL-o-Gram

Click *SPL-o-gram* on the taskbar.

The SPL-o-Gram is a map of all the recorded Loudness Scaling results on a grid with Frequency in Hertz on the horizontal axis and dB SPL on the vertical axis. If data for the patient's hearing levels and UCLs is in the patient records, these levels will also appear on the SPL-o-Gram in SPL.

No measurements are performed on this display.





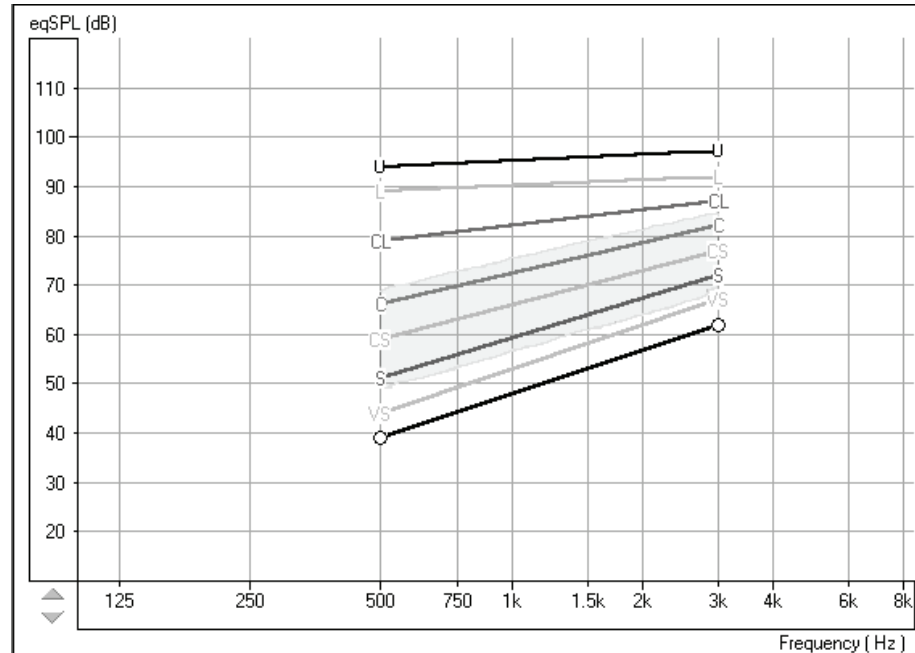
### EXERCISE TWO: USING LOUDNESS SCALING TARGETS IN REAL EAR MEASUREMENTS

The Loudness Scaling data obtained in Exercise One is imported to the Loudness Scaling Real Ear Aided Response (LSREAR) screen.

REAR

Click *REAR* icon on the Loudness Scaling taskbar.

The patient's air conduction, discrete frequency UCL and Loudness Scaling data is plotted on the REAR graph, along with the aided speech spectrum.



The Loudness Scaling lines provide new targets for verifying the real ear performance of the hearing instrument to a range of input level signals.

Perform REM REAR measurements following the procedure learned in Lesson Six.

Aim to match the output of the hearing instrument to the loudness scaling “targets” so that the REAR curve for a soft input level follows the soft (S) loudness scaling line, moderate input levels follow the comfortable(C) target, and ensure loud inputs do not reach the Uncomfortably Loud (UL)line. This will require performing REAR curves for a 50, 55, 60 ,65, 70, 75, 80, 85 and 90dB input.

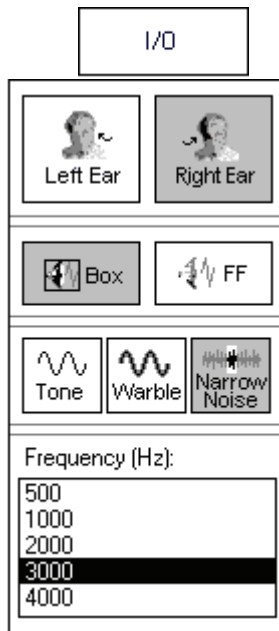
**Tip:** A quick way to perform these measurements is to select the Manual Signal Control (*MSC*) mode to turn the signal on continuously while you change the input level over this range. Continuously monitor the "real time" REAR curve on the screen to locate unsatisfactory response levels.

A more efficient use of the Loudness Scaling data to setting gain and compression is to perform Input/Output measurements described in the next exercise.

**EXERCISE THREE: USING LOUDNESS SCALING INPUT/OUTPUT TARGET CURVES TO SET GAIN AND COMPRESSION**

The Input/Output measurements are used to set the hearing instrument compression knee-point and ratio using the patient’s loudness judgments as a guide. This task focuses on the dynamic properties of the hearing instrument performance, one frequency at a time. The screen is the same as for the Input/Output task in the Hearing Instrument Test menu, however, the grid also displays a “target” Input/Output curve. This “target” curve represents the patient’s judgment levels from very soft to uncomfortably loud as compared to “normal” loudness judgment levels. If a measured curve gives the same result as the “target” curve, amplification for that frequency has been matched to the patient’s perceived loudness perception.

The Loudness Scaling Input/Output (I/O) measurement is a Real Ear Measurement.



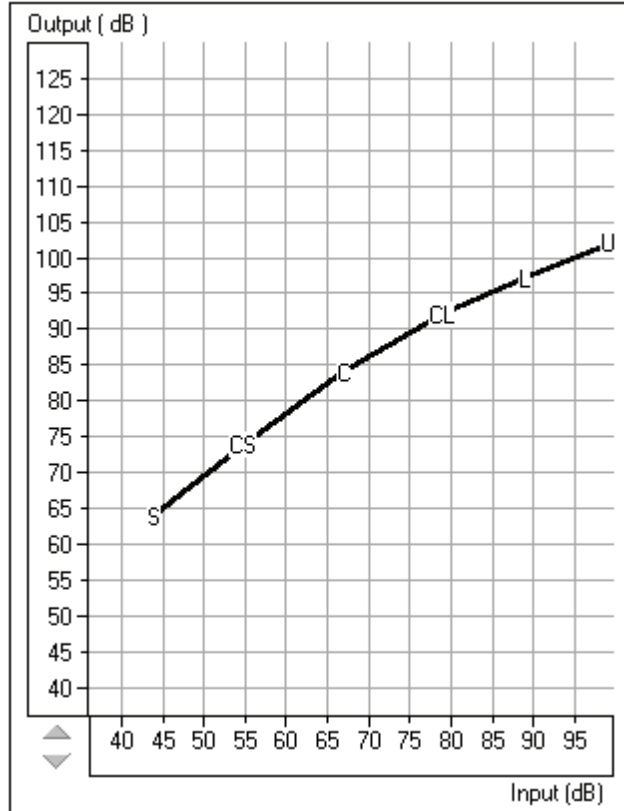
Click the *I/O* icon on the Loudness Scaling taskbar.

Select *Right Ear*, *Box* and *Narrow Band Noise* on the control panel. These are the common default selections.

Click *3000Hz*.

It is recommended you start with 3000Hz as the hearing instrument is most likely to "peak" at 3000Hz and this is the frequency at which a reduced tolerance is often found.

The patient's Loudness Scaling data for 3000Hz is plotted on the I/O graph.



Insert the probe microphone into the patient's right ear canal.

With the probe microphone still in the ear canal, place the patient's hearing aid in their ear. Take care not to advance the probe microphone tube further into the ear when you insert the hearing aid.

Position the patient facing the box loudspeaker at a distance of no more than 3 feet.

Make sure the hearing aid is turned on to half volume.

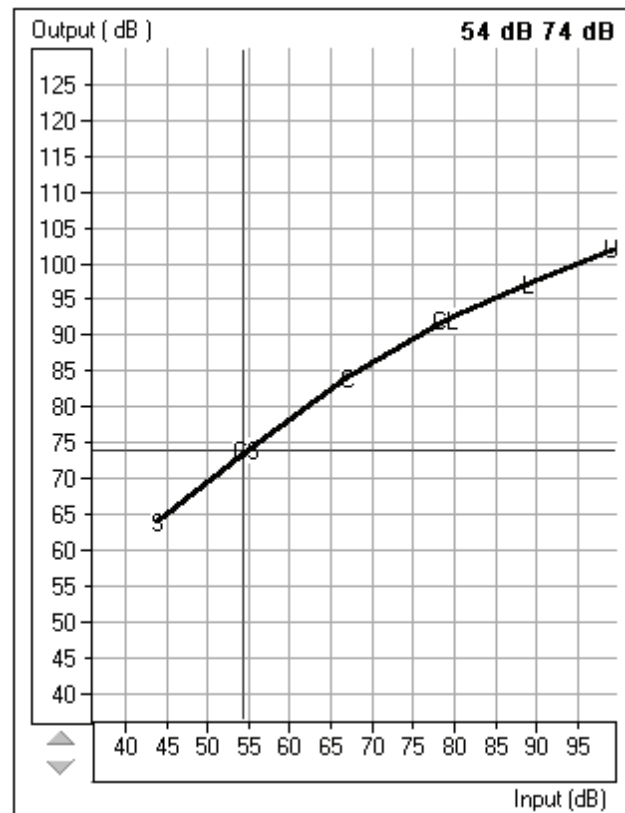


Click *Start*.

The stimulus level will sweep from 50 to 90dB SPL. For this reason, the test environment must be quiet.

Aim to match the slope of the target curve. This allows you to set the gain, kneepoint and compression ratio in the low band of the hearing instrument. When the slope is correct, you can move the curve up or down with the hearing instrument volume control.

INTERPRETATION OF I/O TARGET CURVE

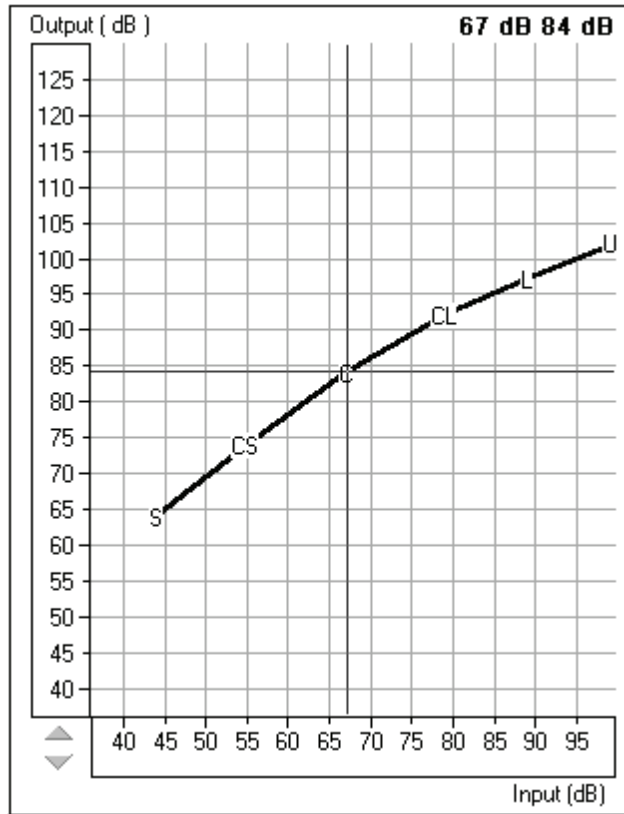


Point the mouse to CS (comfortable, but soft) on the I/O curve.

Read the text at the top of the graph.

In this example, for a soft input of 54dB, the patient prefers the output to be 74dB and judges this level to be comfortable, but soft.

Therefore, the aid needs to provide real ear gain of 20dB for a soft input.

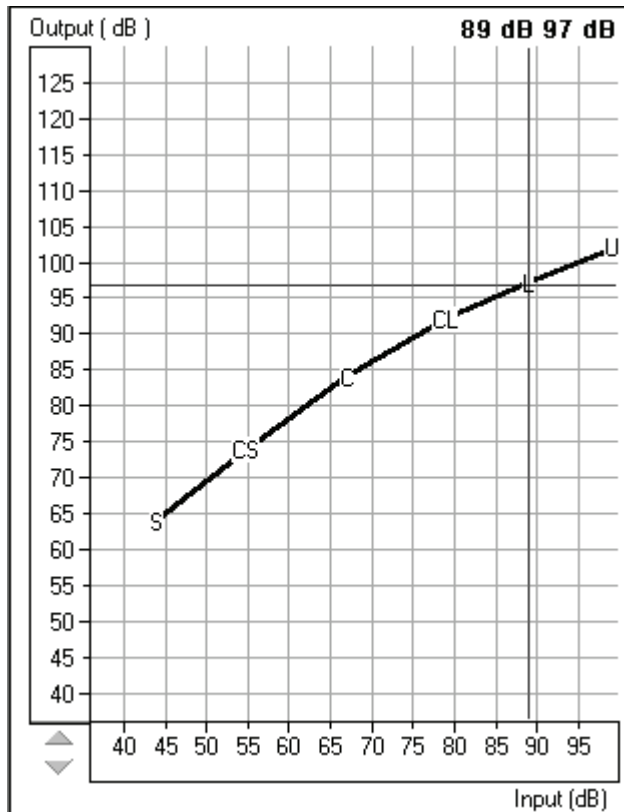


Point the mouse to the C (comfortable) on the I/O curve.

Read the text at the top of the graph.

In this example, for a moderate input of 67dB, the patient prefers a real ear output of 84dB.

Therefore, the aid needs to provide a gain of 17dB for a moderate input level.



Point the mouse to L (Loud) on the I/O curve.

Read the text at the top of the graph.

In this example, for a loud input of 89dB, the patient prefers the output to be 97dB and judges this level to be Loud.

Therefore, a real ear gain of only 8dB is needed for loud input levels.

From the three graphs above, it is easy to see how the gain requirements change for different input levels.

Make adjustments to the hearing aid settings for gain, kneepoint and compression ratio as required and repeat the measurement each time to verify the adjustment.

Repeat this exercise for all the frequencies for which you have loudness scaling data.

Note: It is always recommended you validate all hearing instrument fittings by discovering the patient's subjective opinion on how the aid is performing in real life situations.

#### **EXERCISE FOUR: SOFTWARE CUSTOMIZING OPTIONS FOR LOUDNESS SCALING**

There is a limited number of customizing options provided in the software for loudness scaling.

Number of ascending runs in the IHAAF protocol:

The system defaults to performing one ascending run for each test frequency selected. If you want to perform more than one ascending run, and average the results for each frequency, you can change the number of ascending runs from the toolbar.

Options | Options | Average Number for Loudness Scaling  (default)

Click the mouse in the text box and type in the desired number of ascending runs.

Start Level Sweep

If the ambient noise level in the test room prevents you from performing the I/O curve starting at 50dB, you will need to change the start level sweep to a higher level.

Options | Options | Start Level Sweep At (dB):

Display the Loudness Scaling data on the REAR screen:

If you do not see the Loudness Scaling data on the REAR screen, you will need to check this option.

Option | View | REAR | Show Loudness Scaling

Make sure a check mark appears in this box if you want to see the Loudness Scaling data on the REAR screen.