VIOLA

version 1.0 for Windows

User Manual

(**V**isual **I**nput/**O**utput **L**ocator **A**lgorithm)
A graphical approach to determining a best-fitting
input/output function for choosing and fitting a
linear or non-linear hearing aid.

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Overview of VIOLA

VIOLA (Visual Input/Output Locator Algorithm) is a graphical approach to determining a best-fitting input/output function for choosing and fitting a linear or non-linear hearing aid. The user must provide loudness perception data from the Contour Test (Cox, et al, 1997)[1] or, at the least, audiometric thresholds. This information is used to generate a hearing aid prescription. In the absence of loudness data, threshold data can be used by the program to predict these values. The user then specifies values for compression parameters and observes the goodness of fit between the prescription targets and the performance of the specified hearing aid. Parameter values may be varied until an acceptable match is seen between targets and hearing aid performance. For additional information see Cox, 1995.

SYSTEM REQUIREMENTS

VIOLA is a 32-bit Microsoft Windows®[2] application that can run on most systems with Microsoft Windows® version 95/98. VIOLA for Windows needs at least 1 MB of hard disk space for the program and associated files. A laser printer is recommended but not required for printouts of VIOLA data in graphical form. The printout will be in color if a color printer is used. The Display Properties Setting for the desktop area on the monitor must be set to 800 x 600 pixels in order to display the entire screen.

To install the software, the user should create a new folder to hold the VIOLA program files. Copy SETUP.EXE from the diskette provided to the VIOLA folder and run it, either by double-clicking on it with the mouse in Windows Explorer or by selecting the "Run" command on the Start menu on the Windows desktop. This will unzip all the files required to run VIOLA, placing them in the VIOLA folder.

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[1] Information about the Contour Test, including instructions and worksheets for manual administration of the test, can be obtained from the HARL Web Page on the internet. The address is: http://www.ausp.memphis.edu/harl

[2] Windows is a registered trademark of Microsoft Corporation.

RUNNING THE PROGRAM

The program opens to the Patient Information Screen and is ready for edits to a new file. VIOLA uses the standard Windows pull-down menu interface for invoking its various commands. These operations may be performed with either a mouse or by a sequence of keystrokes. See the Windows manual for instructions on menu selection. Most VIOLA menu options are associated with <Alt> key combinations, in accordance with the Windows user interface standard.

There are three pull-down menus available, corresponding to the labels displayed at the left side of the bar which runs across the top of the screen. The menu labels are: File, Items, and Help. The commands available from these menus perform functions relating to the loading and saving of files, entering loudness data, displaying I/O curves, and accessing help information.

MAIN MENU

Main Menu options (information about each will follow):

> File Menu:
> 1. New ∗
> 2. Load ∗
> 3. Save ∗
> 4. Save as
> 5. Exit
>
> Items provides the selections:
> 1. Patient Information ∗
> 2. Contour Data ∗
> 3. Hearing Aid Database ∗
> 4. I/O Curves ∗
>
> Help has the selections:
> 1. Contents
> 2. Using Help
> 3. About

∗ These selections have an icon available on the toolbar. The toolbar is below the Main Menu bar on the screen and provides icons for quick access to certain program functions. If the cursor pauses on one of these icons a message will appear identifying the function of the particular icon.

THE FILE MENU

From this menu, the user can create, load, and save data files, as well as exit and close the VIOLA program.

New:

This option allows the user to create a new data file. It opens to a blank Patient Information Screen. This menu option is primarily used when you are finished with an already loaded file and you wish to create a new file.

Load:

Selecting this option allows the user to load a previously stored data file. Use the window to access the appropriate subdirectory (folder) and select a file as you would with any other Windows-based program.

Save:

Select this option to save the current file and any edits. If that file does not already have a name, a "Save file as…" window opens to designate a filename and the folder in which to save the file. The data file is automatically given a .vio extension.

Save file as…:

This option saves the current file under a different name or in a second location. It does not erase or rename the copy saved under the previous name.

Exit:

Exits and closes the VIOLA program. <Alt+X> is the keyboard equivalent of clicking on "Exit" in the FILE menu.

THE ITEMS MENU

From this menu, the user can enter information about the patient, select the frequencies for the prescription, enter Contour or threshold data, and enter hearing aid information and specifications. An interactive graph of the results can be opened from this menu and the graphs can be printed.

Patient Information:

This item allows the user to edit demographic information about the individual patient. Dates require a MM/DD/YYYY format. There are also selections for configuring the interactive I/O curves feature of the program. These selections are for the type of hearing aid for each ear, for a monaural/binaural fitting, and for the loudness data that will be used. These selections affect the values used by the program in its algorithm.

VIOLA requires and utilizes loudness data in computing the prescriptive targets for a hearing aid fitting. This data is provided by the user on the Contour Data screen using one of three methods, designated on the Patient Information screen:
- results from administering the Contour Test
- data predicted from only the patient's thresholds
- data predicted from the patient's thresholds and the UCL

Contour Data:

This option accesses a window for entering the patient's Contour or loudness data and for selecting the two frequencies for the I/O graphs.

Below the two charts, designate whether the data entered is in dB HL or in dB SPL. If some of the patient's loudness data is to be predicted (a selection on the Patient Information screen) the "Predict" button will be enabled. Also, note that the gray cells on the table are for predicted data and the white cells are for the user to manually enter values. Press the "Predict…" button at the bottom of the window after entering the thresholds.

The I/O (Input/Output) screens will display two frequencies. Select the two frequencies for each ear below the charts.

Figure 1: the Contour Data screen

CONTOUR Data

Right Ear	THR	VS	S	CSS	C	CSL	LOK	UCL
250 Hz	25	38	49	56	62	69	74	80
500 Hz	30	43	55	62	69	76	81	87
1 KHz	35	48	60	68	75	81	87	93
2 KHz	40	52	63	70	76	82	87	93
3 KHz	50	61	70	76	81	86	91	96
4 KHz	50	61	71	77	82	88	93	98

All values in gray are predicted from THR

Left Ear	THR	VS	S	CSS	C	CSL	LOK	UCL
250 Hz	20	33	45	53	60	66	72	78
500 Hz	25	39	52	59	66	73	79	85
1 KHz	25	40	53	62	69	77	83	89
2 KHz	35	48	59	67	73	80	85	91
3 KHz	40	52	63	70	76	82	87	93
4 KHz	45	57	67	74	80	86	91	97

All values in gray are predicted from THR

Display Frequencies (Right Ear)

Left Graph: 500 Hz   Right Graph: 3 KHz

Display Frequencies (Left Ear)

Left Graph: 500 Hz   Right Graph: 3 KHz

Predict intermediate levels

CONTOUR data entered in: dB HL   dB SPL

Predict intermediate levels

Hearing Aid Database:

This option opens a window for entering and storing specifications for six different hearing aids of the user's choice, which can then be accessed when interacting with the I/O graphic function to choose the best fit. This would be useful when there are specific hearing aids which are preferred or considered often when approaching a fitting.

Select one of the six hearing aid specification pages by using the arrow buttons below the table. Text entered in the "Hearing Aid" field will appear on the printout of the I/O curves, while text in the "Short Label" field appears on the I/O graphic screen.

Enter information about the particular hearing aid from 2cc coupler specifications provided by the manufacturer or from running the hearing aid in a test box to obtain the information. Data cells are provided for entering the Gain for a 50 dB input (this assumes a reasonable volume control setting), Compression threshold 1 and ratio 1 (CT 1 and CR 1), Compression threshold 2 and ratio 2 (CT 2 and CR 2), and the Maximum Output. If a second kneepoint is not provided, CT 2 and CR 2 may be left blank. For a linear instrument, set CT 1 = any value below SSPL90, CR 1 = 1, and the cells for CT 2 and CR 2 may be left blank. If the user leaves CT 2 and CR 2 blank, the program automatically fills in these cells with the values from the CT 1 and CR 1 cells.

The user can enter information about the hearing aid's performance for up to six frequencies. The VIOLA program assumes the compression parameters entered are for an input compression device. If the hearing aid you are specifying uses output compression, type an "o" following the value entered in the compression threshold cell. For example, if a hearing aid's compression threshold is 105 dB and it is an output compression device, type "105o".

I/O Curves:

This menu item displays a screen on which the user may edit hearing aid parameter information for the selected frequencies for each ear and view the resulting input/output functions. From this screen, the user may printout the I/O curves with the hearing aid specifications chart.

The rationale behind using the VIOLA program is to select a hearing aid based on consideration of its gain, maximum output, and I/O functioning at two frequencies.

The I/O Curves screen includes two parts:
- an interactive table of hearing aid parameters at the top of the screen
- adjacent graphs for two input/output (I/O) functions at the bottom of the screen

The I/O functions are for the two frequencies selected on the Contour Data screen and reflect the set of hearing aid parameters specified in the table. The user-entered hearing aid parameters include gain for a 50 dB input, compression thresholds, compression ratios, and maximum output. There is accommodation for two compression thresholds and ratios for use in the case of instruments which allow, for example, a low compression threshold and ratio to deal with

recruitment combined with a high compression threshold and ratio to provide output limiting, or which provide two separate compression kneepoints and ratios, such as with a K-amp circuit.

Printing the Data, Switching Ears: Below the HARL logo on the right are two buttons. Press the printer button to print the current I/O curve graphs with the hearing aid parameter table. To the right is a button with an ear icon. It is used to switch between screens for the right and left ears.

Figure 2: the I/O Curves screen

Press to print

Press to switch between right/left ears
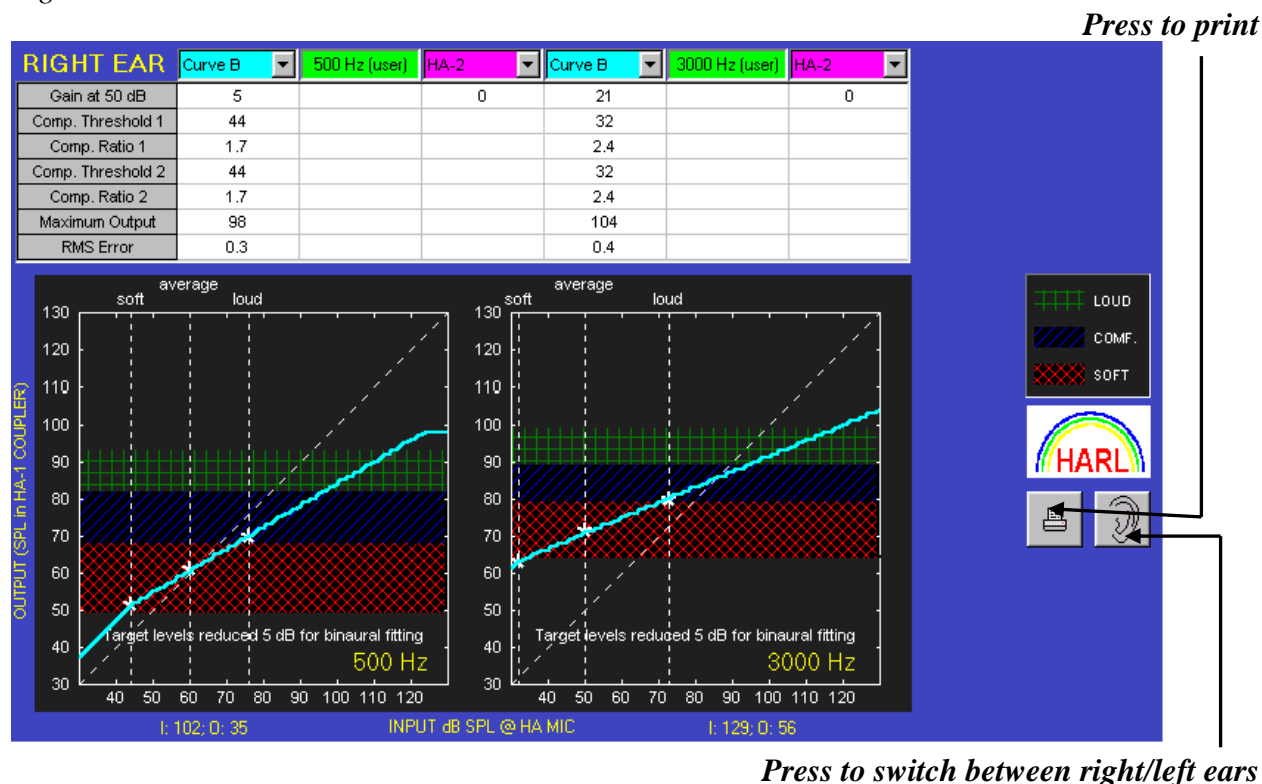
The Hearing Aid Parameter Table:

Each column is used to specify parameter values for a particular hearing aid. Columns 1, 2, and 3 control I/O functions on the graph on the left. Columns 4, 5, and 6 control I/O functions on the graph on the right. Use <Tab> or the mouse to move between columns and the cursor keys to move up and down a column.

The VIOLA program assumes the compression parameters entered are for an input compression device. If the hearing aid you are specifying uses output com-pression, type an "o" following the value entered in the compression threshold cell. For example, if a hearing aid's compression threshold is 105 dB and it is an output compression device, type "105o".

If a second kneepoint is not provided, CT 2 and CR 2 may be left blank. For a linear instrument, set CT 1 = any value below SSPL90, CR 1 = 1, and the cells for CT 2 and CR 2 may be left blank. If the user leaves CT 2 and CR 2 blank, the program automatically fills in these cells with the values from the CT 1 and CR 1 cells.

Figure 3: the Hearing Aid Parameter Table

parameters for graph on left   parameters for graph on right

RIGHT EAR	Curve B	500 Hz (user)	HA-2	Curve B	3000 Hz (user)	HA-2
Gain at 50 dB	5		0	21		0
Comp. Threshold 1	44			32		
Comp. Ratio 1	1.7			2.4		
Comp. Threshold 2	44			32		
Comp. Ratio 2	1.7			2.4		
Maximum Output	98			104		
RMS Error	0.3			0.4		

automatic curves A-E
user entered parameters
from Hearing Aid Database

Each of the 3 columns for a graph gives the user a different approach to selecting the parameters for a best fit for the individual patient. This information can be used to help select the best instrument. The row labeled "RMS Error" on the table indicates how much a particular curve deviates from the prescription targets. When values in the table are changed, the I/O function is automatically changed after pressing <Enter>.

1. Columns 1 and 4 display blue I/O functions. Click on the pull-down menu on the column to select Curves A-E which are generated by the VIOLA program. Curve A depicts linear performance. Curves B, C, D, and E all contain varying amounts of compression. The user may choose a desired fit from these auto-curves and then look for a hearing aid with similar specifications. *(See Hearing Aid Parameters Figure 3 above.)*
2. Columns 2 and 5 display green I/O functions. These columns are open for the user to hypothetically investigate and experiment with adjusting the different hearing aid

parameters to obtain a desired fit. Enter or edit the values in these columns, then press <ENTER> to produce/redraw this function. *(See Figure 3 above.)*

3. Columns 3 and 6 display pink I/O functions. Click on the pull-down menu on the column to select one of the various hearing aids which were entered in the Hearing Aid Database (see previous information about the Database under the ITEMS menu). Selection of the hearing aid which provides the best fit can be made. *(See Figure 3 above.)*

The I/O Curve Graphs:

Each graph shows:

- three horizontal shaded bands which correspond to the soft, comfortable, and loud regions (see the legend on the right of the screen) for the patient, as determined by the Contour Test or as predicted by the VIOLA program from the patient's thresholds

- the vertical dotted lines show 1/3-octave band values for soft, average, and loud speech input levels at the hearing aid's microphone

- the diagonal dashed line indicates zero gain

- the three stars are the amplification targets according to the VIOLA fitting procedure

Each I/O function on the graph is color-coded to the parameter table column to which it corresponds. The ear icon button toggles the displayed graphs between the right and left ears.

Figure 4: the I/O Curves screen
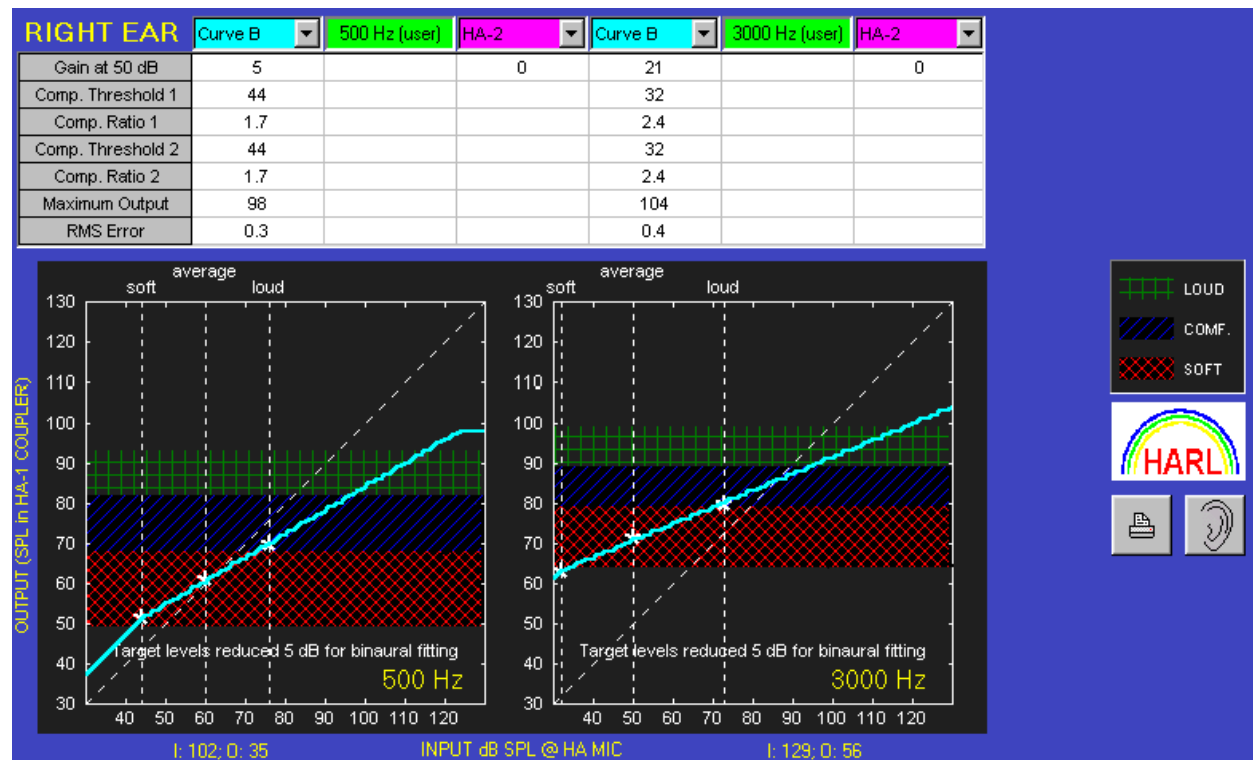
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