EyeHarp Manual

Using the EyeHarp

For the best EyeHarp experience, you will need an eye tracker. An eye tracker is a special device, a camera and a dedicated software, that can detect where you are looking at every moment. It is normally placed under the screen.

We recommend [Tobii 4C](#) as an affordable device with great performance. The EyeHarp is compatible with any device that communicates through the EyeX server.

Alternatively the EyeHarp can be played with any other device that can control the mouse pointer. For example, a mouse, a head tracking device, a trackball, or a touch-pad.

IMPORTANT: To use mouse input instead of gaze input, you must change the EyeHarp's settings. This can be done via a configuration text file named "eyeharp.txt". Please read the Advanced Setting section to learn how to configure these settings.

Making Sound

The EyeHarp comes with a simple built-in synthesizer that offers basic sounds. For better sound quality and variety of instruments, the EyeHarp can be used as a MIDI controller.

You can select the three basic sounds in the melody layer: two theremin-like sounds (theremin and sine tone) and one vibraphone-like sound. When using the EyeHarp as a MIDI controller any instrument sound can be produced. You can select the MIDI channel in the melody layer.

Remember, a MIDI controller does not produce any sound. Instead it sends control messages to another external synthesizer. Whether EyeHarp works as a MIDI controller or as a synthesizer, is set in the configuration file or through the setup menu.

Interface

The interaction with the EyeHarp is done by looking at buttons and selecting them, similarly to clicking on a button with the mouse. A button in the EyeHarp interface is a circle with a small focus point in the center. To select a button, look at the focus point of the button for 700 ms. This method is known as dwell-time. Alternatively, as explained above, the EyeHarp can be configured to performs selection with the mouse pointer.

Remember, the notes you play are not buttons. When you look at a note, it will sound instantly without delay.

The EyeHarp consists of two layers: the melody layer, and the step sequencer layer.

Melody layer   sequencer layer
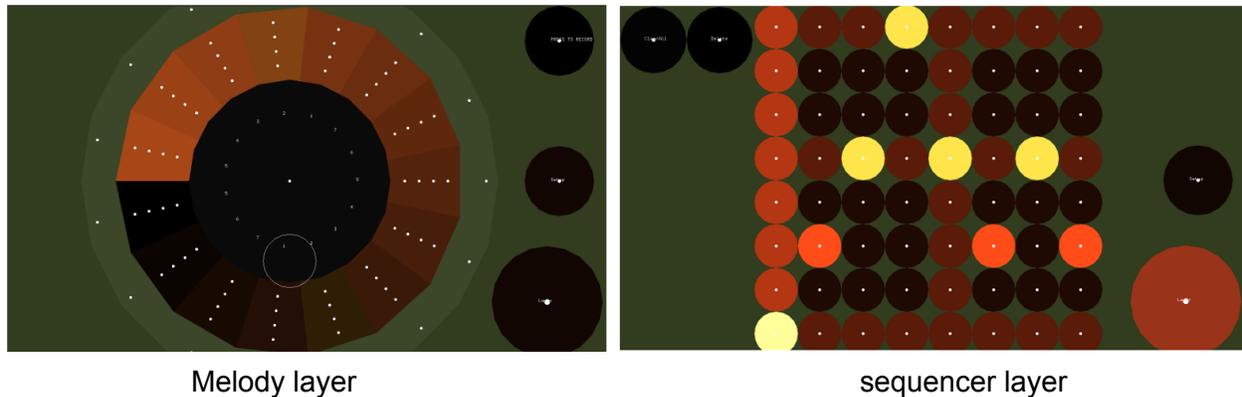
To switch between the two layers, look at the "layer" button on the bottom left of the screen.

The melody layer:

The melody layer is the main one, where the performer can play melodies by looking at the desired notes, as well as to select scales, sounds, transpositions, and harmonizations.

The note selection area is a pie-like keyboard, where notes are arranged in a scale, and selection depends on direction. The notes divide the circle into slices, with a specific selection area for each note. This design improves temporal control, and it is effective for playing free-flowing melodies.

The notes are placed at the perimeter of the pie, with a note selection area for each one.

When the user looks at each note area, the corresponding note or chord is triggered.

Looking at the outer region of the note area will produce louder dynamics, and looking at the inner region of this area will produce softer dynamics. To facilitate dynamic control, the user may use the 4 focus points provided in each note area.

Little eye movements would create a vibrato, adding to the musicality and enhancing expressiveness.

The EyeHarp is a diatonic instrument, meaning that the user sets the scale before or while playing. The default scale is of the EyeHarp is C major. This can be changed through the the setup menu or through the configuration text file (see Advanced Settings).

The first note is placed at the position "9 o'clock" of an analog watch and corresponds to the note G3. Next to it at around "8 o'clock" is placed the next note, A3. Following the counter-clockwise direction, all notes are placed around the pie.

The number of slices in the pie can be configured both at the setup menu of the EyeHarp or through the configuration text file (see Advanced Settings).

When the "show semitones" function is active, between the slices appear cyclic buttons that correspond to the semitones between the notes of the scale.

When the "show chords" function is active, the last 7 slices of the interface are used for changing the chords of the arpeggio created in the step sequencer (see below).

At the center of the pie there is a black rest area, a neutral are, where no button is placed. There, the user can look freely without triggering any event.

A replay note button will appear at the center of the pie when the user looks at the selection area of any given note. This allows the performer to easily and quickly play the same note twice consecutively. The same note can be played again and again just by looking at the selection area of a note, then back to the center of the pie and so on. The replay note button disappears when looking at the rest area. Then, you can look freely inside the neutral area without triggering any event.

To release a note, simply trigger a different note or look at the release area, which is the green area outside the pie.
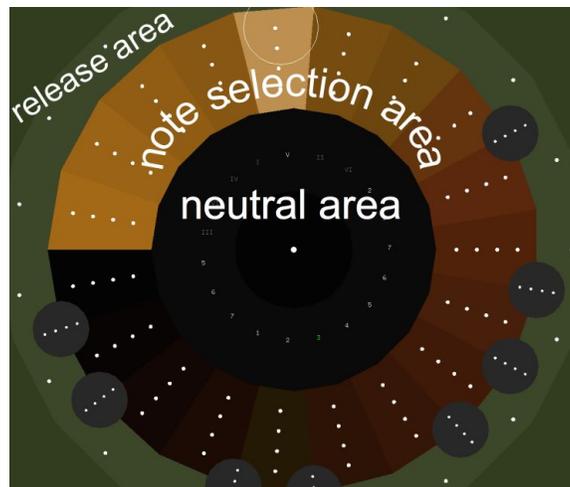
Some numbers are written inside the neutral area. The purpose of these numbers is to allow the user to think and look which will be the next note to play, without triggering the next note.

Number 1 corresponds to the note C (when we are in C major), 2 to D, 3 to E, etc. The Latin numbers describe the scale degree of the chords: I is C, II is D, etc. Whether the chords are minor or major depends on the set scale.

Optionally, through the configuration text file (see Advanced Settings), additional release area can be placed between the note selection area and the neutral area, as shown in the image below. This feature seems to be suitable for users that use head-tracking instead of eye-tracking. Nevertheless, some users that use eye-tracking also prefer having this feature active.
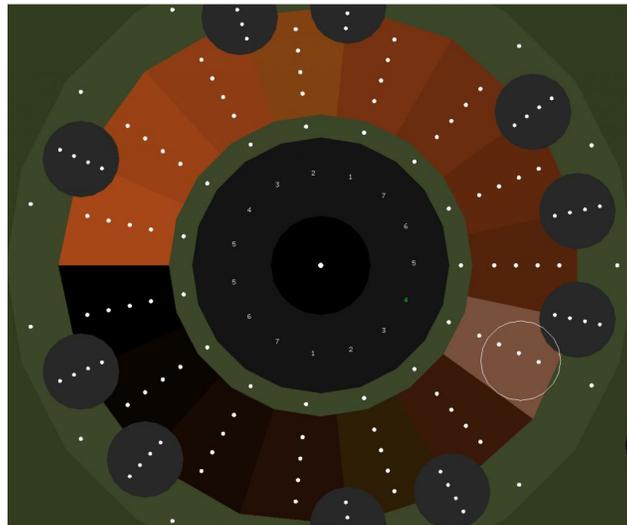
additional green release area in the center

The performer can create arpeggiate chords accompaniment with the step sequencer layer. These chords can be controlled by the melody layer, by activating the "show chords" function.

The step sequencer layer:

The step sequencer layer consists of a square grid of note-buttons. The default grid is 8X8, but this can be configured in both the setup menu and the configuration text file (see Advanced Settings).

Buttons in the step sequencer are selected and deselected by looking at them.

The buttons in each row correspond to the notes of the scale from left to right. The first button in the row is the first note of the scale, the second button is the second note of the scale, and so one. For example, when the EyeHarp is tuned in C major, the buttons in the first row correspond to the note C, the button in the second row to D, in the third row to E, etc.

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The step sequencer plays the notes in the order of the rows from left to right. The notes selected in the left most column will sound first. The step sequencer will play each note as one beat of the given tempo. For example, If the tempo is set to 60 beats per minute, it will take 1 second to play each row. If the tempo is set to 120 BPM, it will take 0.5 a second to play each row.

The step sequencer plays the grid in a loop. When the final, right most column is reached, the playback starts over again immediately from the first, left most column.

You may insert one or multiple note per column. This needs be configured through the text file (see Advanced Settings).

To delete the last inserted note, select the "delete" button on the top left of the screen.

To delete all of the inserted notes, select the "ClearAll" button.

The Setup Menu

Select the "Setup" button on the right of the screen, to load the setup menu. Use this menu to adjust a number of settings. Each layer has different settings, relevant to the specific layer.
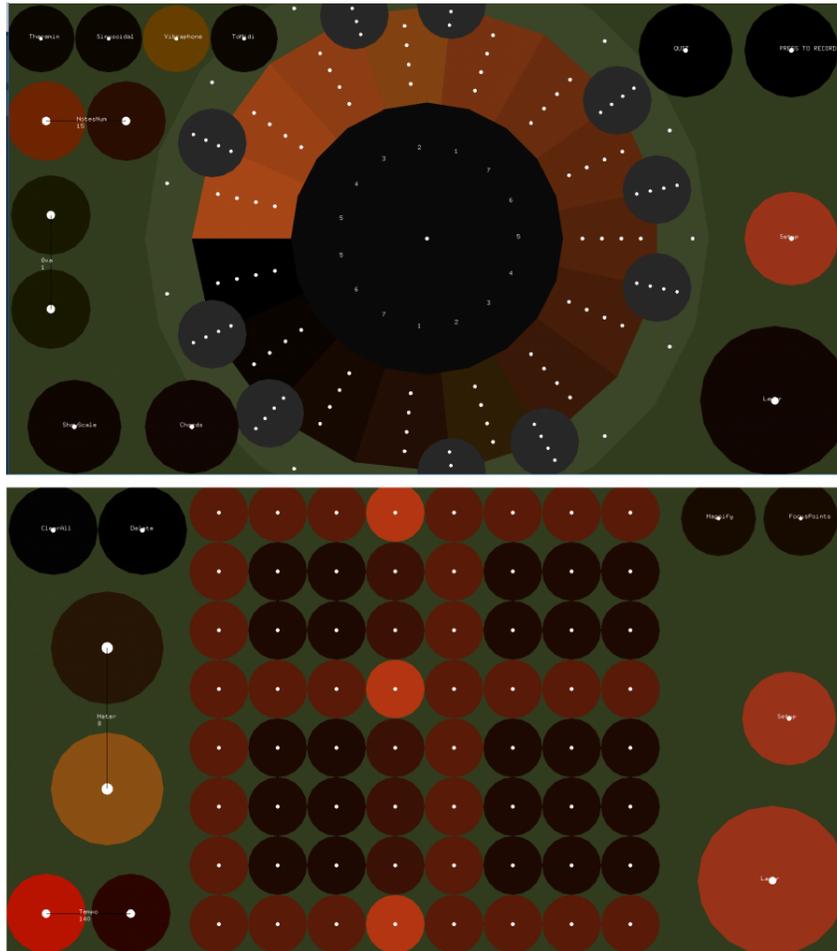

Melody Layer Settings:

On the top left corner you can select between three sounds: theremin, sine tone, and vibraphone. The default is vibraphone. These sounds are generated by the EyeHarp's built-in synthesizer.

To use the EyeHarp as a MIDI controller, select the "toMidi" option. In that case, the EyeHarp will look for virtual MIDI ports, such as loopMIDI or LoopBe1. Then, a VST application, such as Kontakt, can be used to load sounds and trigger them with the EyeHarp. Select different MIDI channel to change instrument, according to your own VST settings.

To increase or decrease the number of visible notes on the pie keyboard, use the horizontal "NotesNum" buttons on the left. Adding more notes will reduce the size of the selection area of each note, and removing notes will make each note selection area larger.

To raise or lower the register of the notes, use the two vertical "8va" buttons on the left.

Activating the "ShowScale" button on the bottom left, will let the user to tune the EyeHarp to different scales. After closing the setup menu, a number of scales to select from will appear on the left of the screen. Via the configuration text file (see Advanced Settings), you may change the preset scales and create new scales and tunings for the EyeHarp.
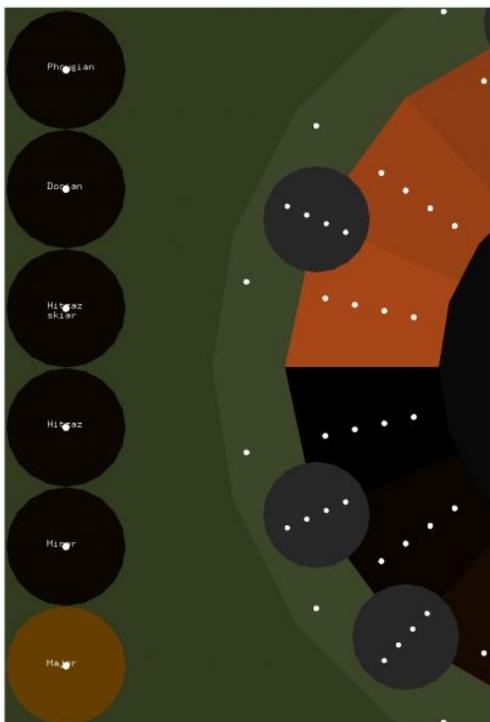
To quit the application select the "QUIT" button on the top right. Selecting the Quit button once will change its position. Then, select the same button to actually quit. This two-step process prevents exiting the application by accident.

The "PRESS TO RECORD" button on the top right lets you record a sequence of chords. This sequence can be used as an accompaniment to the melody. It is also possible to change chords while playing a melody, but sometimes it is more convenient to record the chords in advance.

To record a chord progression, first create one in the step sequencer layer.

The record button will turn red to indicate that the recording has started. To stop the recording, select the record button again. Once the recording stopped, the playback will start automatically, playing in a loop.

The 'Layer" button on the bottom right switches between the melody layer and the step sequencer layer.

Step Sequencer Layer Settings:

The "ClearAll" button, on the top left, deletes all of the inserted notes

The "Delete" button, on the top left, deletes only the last note inserted to the sequencer.

To increase or decrease the size of the step sequencer grid, use the two vertical "meter" buttons on the left. The size of the grid affects the time signature of the arpeggio. For a example a size of 7X7 means a rhythm of 7/8. The recommended sizes are 6, 8, 12 and 16.

Increasing the size of the grid reduces the size of each note, and decreasing the size of the grid makes each note larger.

To raise or lower the tempo in which the sequencer plays the grid, use the two horizontal "tempo" buttons on the bottom left.

When activating the "FocusPoints" button on the top right, additional focus points will appear. If the accuracy of the eye tracker is not good, these additional focus point can help the user select notes more easily.

When activating the "Magnify" button on the top right, a magnification lens will appear. Use the magnification lens a to magnify regions of the step sequencer. This helps with selecting and deselecting notes when a big grid size is desired, and the grid buttons are small.

Inside the /bin folder, where the file EyeHarpVS.exe is found, you will find a configuration file named EyeHarp.txt. Using this file, you may configure the EyeHarp with settings of your choice.

Each line of this file shows a parameter name and a value. Some values are boolean (true-false) and some are numerical. These are the standard configurations of the EyeHarp.

Most of these settings can be modified through the setup menu. Use the text file configuration only if you want to make permanent changes.

Available parameters:

discNotesNumber 15
This is the number of notes in the pie keyboard of the melody layer. The default is 15 notes.

stepSequencerNotesNumber 8
This is the size of the step sequencer grid. The default is 8 steps.

chords 0
This is equivalent to the "show chords" button. When set to 0, the pie keyboard will play only single notes. When set to 1, the last 7 note selection areas will be dedicated for changing the chords of the arpeggio created in the step sequencer.

showScale 0
Startup value of the showScale option described in the Setup menu.

scalePreset 1
This option can only be set through the configuration file. If set to 1, when the showScale is active (also set to 1), the user can tune the EyeHarp to a number of preset scales. If set to 0, the user will be able to manually construct the scale, by tuning each note of the scale to the desired value.

mouseEyeTracker 0
If set to 0, the input of the mouse pointer controls the EyeHarp. If set to 1, the EyeHarp will look for a supported eye-tracker, and the interface will be controlled by the data received from the eye-tracker. The mouse/EyeTracker input can be altered also when running the application, by pressing the 'm' key on the keyboard.

clickDwell 1
This option affects the way buttons are pressed in the EyeHarp. When set to 0, a mouse click will be used for pressing control buttons and the buttons of the step sequencer. When set to 1, a dwell time selection method is used: a button is triggered when a time threshold is reached, in which the gaze/pointer stays on a button. The dwell time in most cases is 700 ms. In the repeat buttons (e.g. for adjusting the tempo), this value is smaller. Remember that the notes of the melody layer are not buttons. Notes are always triggered instantly.

bufferSize 512
If you use the internal synthesizer for producing sound, and you experience crackles in the sound, this value should be increased.

help 0/1
Hides (0) or shows (1), a help text on the top right of the screen.

tomidi 0/1
0: at startup the sound will be generated through the internal synthesizer.
1: MIDI messages will be send to the virtual MIDI port.

fullscreen 0/1
Sets whether the EyeHarp will start on full-screen or not.

monophonicStep 0/1
If set to 1, the step sequencer will be monophonic. This means that one note can be selected per column. If set to 0, multiple note can be selected per column.

fixationSamples 4
In order to ignore noisy data, a fixation detection algorithm is utilized. Fixation is how much time, in frames, we look at a specific point. In this case, when the value is set to 4, 4 frames (~133 ms) will be used to determine a fixation. If we want to make the system more responsive, this value can be reduced. Nevertheless, if this value is too small, when blinking there is the possibility of triggering notes accidentally.

showGaze 0/1
Determines whether the circle indicating the area where the user is looking at appears or not.

LoopBe_loopMIDI_other 0/1/2
Lets you select the virtual MIDI port. In case both LoopBe and LoopMIDI virtual ports are installed, select which one is preferred. Select 2 for a different MIDI virtual port.

semitoneActive 0/1
Determines whether the semitones will appear (1) or not (0) in the pie keyboard.

transpose 0/1
By default, the EyeHarp is tuned in C. Through this setting it can be transposed to any tonality.

inRelease 0/1
This option activates (1) or deactivates (0) an additional release region placed at the perimeter of the neutral area.

cc1/cc2/cc7/cc11/afterTouch 0/1
Sets which MIDI control message to send from the EyeHarp interface. The value of the message is determined by the distance from the center of the pie keyboard. By default, all are set to 0, except from cc7 which corresponds to the channel volume.

MINVOL 60
Set the minimum velocity and cc message value to be sent. Range is 0-100. If the distance corresponds to volume, this determines the minimum volume of the melody layer.

FIXVEL 80
Useful when the EyeHarp is controlled with a head tracker or a mouse. When this value is high, notes will be triggered even when the cursor passes quickly through the note selection area. This might cause triggering notes accidentally. If the value is low, the cursor will have to be relatively still for a note to be triggered. If this value is too low, the system might become less responsive. In other words: high value will make the EyeHarp more responsive, at a risk of losing control. Low value will make the EyeHarp more stable, at a risk of low response.

loadSong 0
Inside the /bin folder the user can create songs for studying. When a song is loaded the EyeHarp shows the notes of the melody one by one. We you play the correct note, the next one will be illuminated in red. This way the user can learn written melodies.

The songs are in .sng file format. If the loadSong value is set to 1, the program will try to read the file "1.sng". If it is set to 2, it will load "2.sng", and so on. If set to 0, no study file will be loaded.

The format of the .sng files is the following:
1st line: transposition value. 0 corresponds to C scale. 1 to C#, 2 to D, 3 to D#, and so on.
2nd line: scale. 0 2 4 5 7 9 11 corresponds to the major scale.
Then, the notes of the melody are written in the consecutive lines, with one line for each note. The information of each note must be written in this order:
octave note-number flat/natural.
For example, the line 1 2 b refers to the note D flat in the first octave; the line 2 5 _ refers to the note F natural in the second octave.

Additional Information

You can read our most recent publication at the international Journal Frontiers in Psychology. This publication describes the interface and the results of a conducted evaluation process. You can also watch this YouTube video. Make sure to watch it on a computer, with annotations enabled, as explanatory comments appear during the performance.