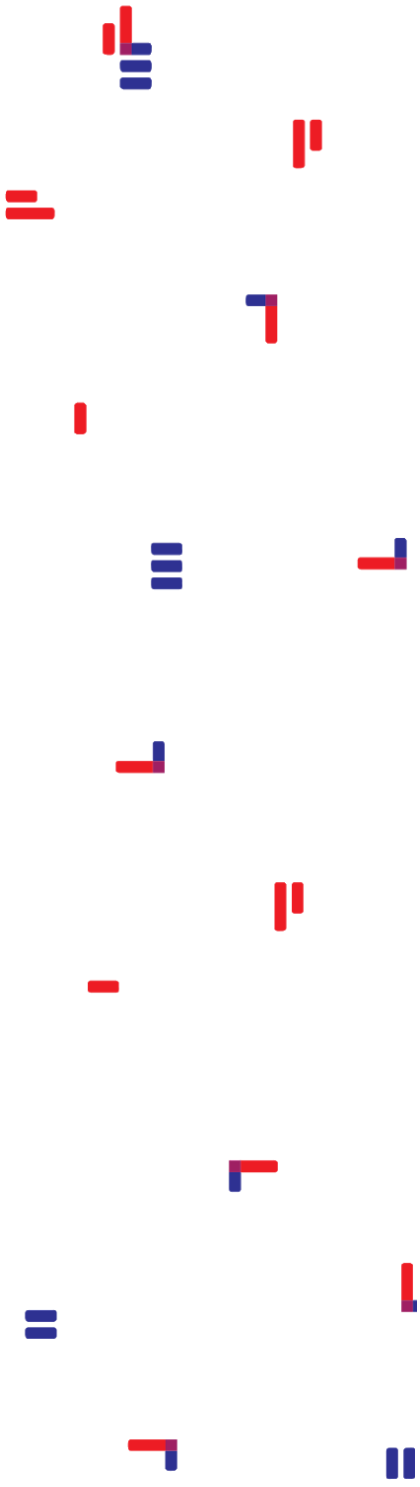


evrisia **BV1**

User Manual

V. 1.0

1. Introduction

a. Definitions

The Subject: In this document, the Subject refers to a person wearing the Virtual Reality headset and experiencing the VR visual stimulus, and they are holding the controllers.

The User: In this document, the User refers to the person operating the computer, looking at the computer monitor.

The UI or User Interface : In this document, the UI refers to buttons, sliders, toggles, and controls located on the computer monitor and not visible or accessible to the Subject. It is assumed the User is a trained professional clinician.

b. Intended Use Statement

i. Intended Use

Evrisia BV1 is intended for displaying visual objects in Virtual Reality in such a way as to simulate similar objects used in Binocular Vision Tests in physical reality .

ii. Indications for Use

Evrisia BV1 presents visual stimuli that is similar to Binocular Vision Tests. These do not provide test,data, or diagnostic information directly but are intended to be used to aid diagnosis of certain binocular vision disorders associated with eye alignment and normal eye function. Populations who can be exposed to the stimuli are anyone indicated to be capable of using the system as specified by the hardware manufacturer.

iii. Limitations

Only Subjects who meet the requirements indicated by the hardware manufacturer should use the system. Subjects who do not meet these physical requirements should not use the system.

iv. Contraindications

This device should not be used for diagnostic purposes as a sole data source. The device is not intended for anything but the

aid of diagnosis of binocular vision disorders. Subjects are intended to experience Evrisia BV1 while seated, not standing or walking around. It is not intended to assist in the diagnosis of any eye disorder but as indicated above.

c. Overview

Evrisia BV1 is a series of virtual reality based tests to assist in the measurement of Eye function by presenting stimuli that approximate or improve upon the gold standard testing currently in use throughout Ophthalmology and Optometry. The system provides information related to Visual Acuity, Eye function, Eye and Head Movement, Visual Field, Eye Alignment, Color detection and Pupillary Response.

As it happens, visual systems function the same way in Virtual Reality as they do in real life, so it is therefore possible to do many of the eye tests conducted in an Ophthalmological setting while benefiting from the precision and reproducibility of a simulated environment. This also greatly speeds up setup and testing time, and helps ensure less qualified individuals can meaningfully contribute to gathering data, helping to free up valuable time of the experts.

In this version BV 1 does not provide information relating to visual refractive corrections, as with a phoropter, as this would require deformable lenses which are not, as of release time, currently available in Virtual Reality. It is also currently unable to provide Fundas images or do Visual Field tests beyond the capabilities of the device, which, as of this release, are limited to a 110 degree visual field. As hardware devices evolve we hope to incorporate these kinds of tests as well as what we currently offer.

In order to make the testing experience more precise, BV1 features Protocols, which will ensure test settings are consistent from subject to subject, and appointment to appointment. This includes the scale, distance, rotation, lighting,

and other context settings - all of which will be perfectly consistent due to the nature of Virtual Reality.

In order to make the testing experience more fun, particularly in orientation, this version of Evrisia BV1 includes Evrisia Art - a non testing program that allows the subject to paint shapes in Virtual reality all around them, and then move the shapes around. Not only is this fun, but we have found it helps reduce anxiety by giving the Subject a sense of control in their environment.

We'd like to acknowledge the help of several individuals and institutions, who have helped make Evrisia BV1 possible. We have had generous support from Innovacorp, the IWK Foundation, Dalhousie University, Copernicus Studios Inc, Dr. Robert Laroche, Dr. Darren Oystreck, Dr. Francois Tremblay, Steve VanIderstine, Dr. Johane Robitaille, Dr. Leah Walsh, Sandy Morrison of Quality Systems Atlantic, and Gabrielle Masone of Coloursmith Labs. Advisory support from Brad Langille, Michael Morris, Margaret Palmeter at Dalhousie Industry Liaison and Innovation, and Dr. Aaron Newman of Dal Neuroscience.

At Electric Puppets we are Ryan Cameron - CEO, Jonathan Gallant - President, Ed Webber - Partner, Matt Webber - Partner, Kyle Ingalls - CTO, and Ronda Brown QMS and project manager.

2. Initial SetUp

a. Hardware

Hardware should be set up that is compliant with OpenVR, supports Steam VR, and will be sufficiently capable of running Virtual Reality.

A Virtual Reality System will need to be installed and in place, we have currently only tested Evrisia BV1 with both the HTC VIVE and the HTC VIVE Pro.

We also recommend Eye Tracking. Evrisia BV1 is compatible with Tobii VR Eye Tracking as well as Pupil Labs VR Eye Trackers. These should all be set up and running per the instructions on their websites.

b. Software

i. Eye Tracking

1. Video Stream

Before launching the Evrisia BV1 Software, the eye tracking software should be running and showing a live video stream if it is capable of doing so. As of this writing, Evrisia BV1 is only compatible with video stream output from the Pupil Labs VR eye tracking system.

2. Telemetry Data Stream

As of this writing, Evrisia BV 1 does not record the telemetry of the eye, that will be in subsequent releases. We have tested it with both Pupil Labs and Tobii, so it should be forthcoming.

ii. SteamVR

1. What is SteamVR?

Steam VR is software that manages the HTC Vive hardware under Windows based computer hardware. It is available for download at steam.com and needs to be installed and up to date on the Hardware system. Electric Puppets cannot guarantee the functionality and availability of Steam VR, as it is maintained by Valve Inc, a separate company unrelated to us.

2. Installation, setup and calibration

Steam VR installation and calibration instructions are part of the program, and instructions on how to perform calibration - a step by step easy to follow part of the overall HTC Vive installation - are available with the VR system itself. The VR

room does need to be calibrated properly before using Evrisia BV1 as this will affect precision of measurement.

iii. Local Settings

1. Laser Pointer

a. Description

The laser pointer adjustment adjusts the position of the laser pointer relative to the mouse. Adjustments are necessary as the monitor resolution and resolution of the headset as well as the IPD will affect the laser pointer tracking precision.

This setting only needs to be adjusted when not running the program in full screen mode, or when the headset or monitor hardware is changed and resolutions are different than before in either device.

To begin, press the Laser Pointer Adjustment button here:

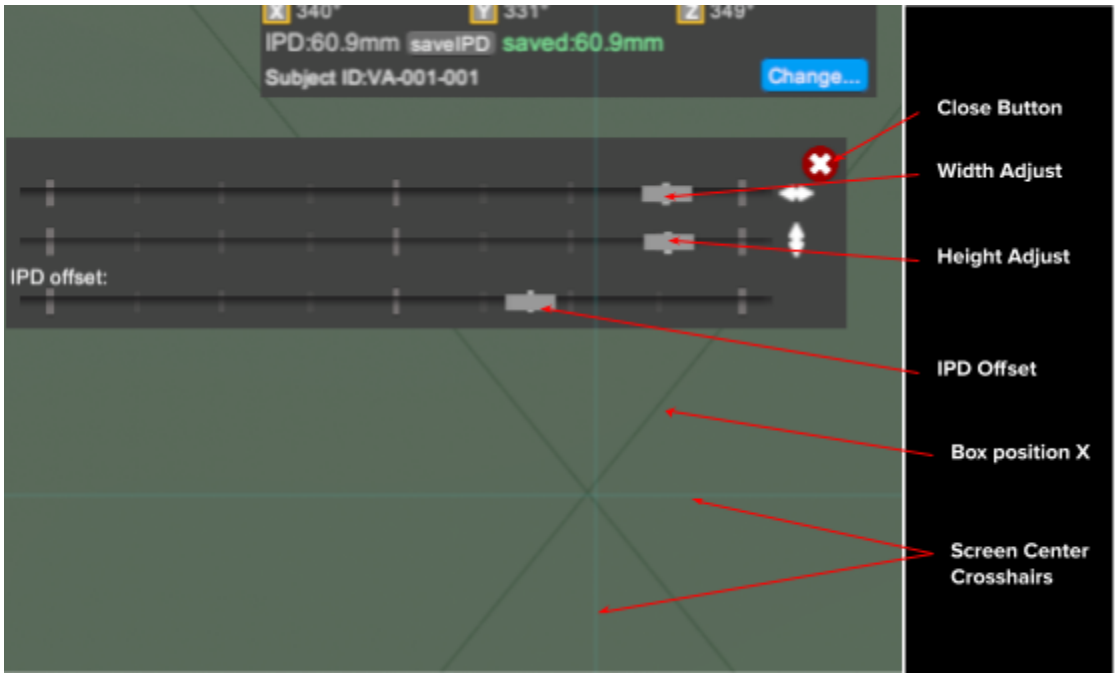
b. Local Monitor/headset calibration

Once pressed, a window with three sliders will appear. The top two sliders will adjust width and height of boxes that appear in both the left and right sides of the monitor. The objective is to make the boxes as wide and as tall as possible without going over width or overheight.

c. IPD Offset compensation slider

The bottom slider will center the boxes based on the current IPD. You will see slight blue “cross hairs” on the computer monitor, the centers of the large X in each box should line up with the center of the cross hairs on the left and right sides respectively.

You may need to adjust the last one again if the IPD varies from Subject to Subject, but the width/height should be fine once the hardware is set and does not change. Settings are saved as they are changed. When complete, close the 3 sliders window by pressing the close button in the top right.



Whether each of these is being actively tracked is saved in Local Settings.

2. Current Test

The current test that was last selected is saved in Local Settings.

3. Protocols

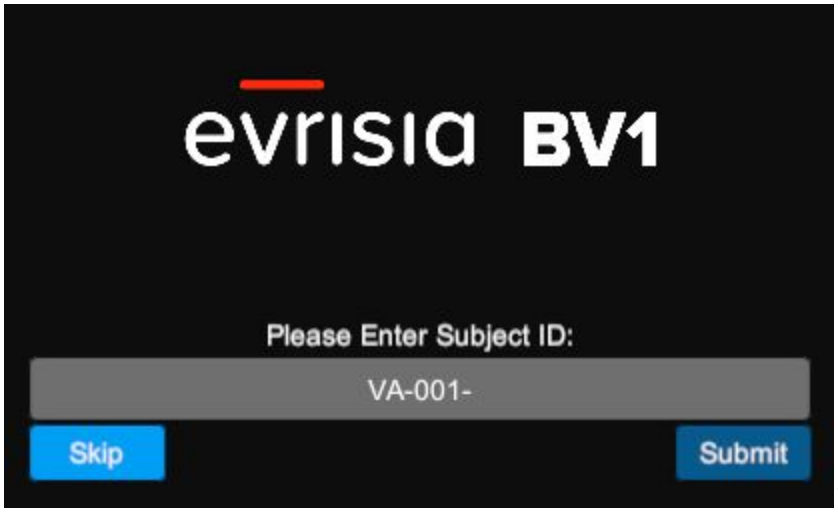
Protocols are saved in the main program settings folder (not the Subject folder) and can be edited relative to the computer the program is installed on. Altering protocol instructions will be discussed in detail in the appropriate section below.

3. Subject Settings

a. Initialization

i. Create Subject ID

On opening the program, a window pops up asking for the subject ID, like this:



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Once a subject ID is entered and submitted a new folder will be created if the subject ID is not currently in the local computer system, or the program will use the selected subject ID folder if it does exist.

ii. Ethics Considerations

The Subject's personally identifiable information, for ethical purposes, needs to be kept private. The software only records non-personally identifiable telemetry data but can record video of the eyes of the subject without audio. This option must be discussed with the Subject prior to the recording of it, and they need to be provided with the option to not record it if they feel it is personally identifiable and are uncomfortable with that. Since the data will reside ONLY on the local computer and not exit the facility or be available on the internet as part of the terms of use of our software, the patient has a reasonable expectation of privacy.

iii. Subject ID lookup device (separate)

To be compliant with ethical considerations, a lookup device that is password protected, such as a tablet containing a spreadsheet, should be available to cross reference the Subject with their personally identifiable information. This table should not exist on the computer hosting our software. The only Subject data should be the ID and files created as described here.

iv. Subject ID Folder contents

The Subject ID folder will contain the following items, all of which are specific to the Subject themselves.

1. **Screenshots**

When the screenshot button  is pressed, a screenshot of the current monitor will be saved as a .png file with the current test name, date and time as the filename.

2. **Screenshot data file**

At the same time as a screenshot being taken, a file containing additional settings at the time but not currently visible necessarily will be saved with the screenshot. In a future version of BV1, we will enable the viewing of these files.

3. Preferences

The Preferences file for a given Subject contains the following information: Displacement Settings, Color Filter Settings, Blur Settings, Rotation Settings, and Subject Saved IPD. These are updated/saved every time they are changed.

4. Recordings

Recordings contain, for every frame - up to 60 or 100 per second, the following information: Head/Controllers position and rotation, User Interface settings, Eye Telemetry data if available, and Eye Video if available.

b. Continuous Subject Data

i. Change Subject

The subject can be changed at any time (with the exception of during recording and playback) to a different Subject by pressing the Change... button, at which time they will be prompted to go through the same steps of choosing a Subject ID or creating a new one as at the start of the program.

ii. Updating IPD

The Hardware IPD setting is, on HTC Vive, controlled by a small dial on the headset itself. This cannot be programmatically controlled as of writing this document, but we can read its current setting and save it in the subject preferences, for future reference. To ensure a consistent IPD setting for the Subject, it is recommended that once the IPD is set to where the Subject prefers it,

“saveIPD is pressed, and then whenever that Subject is loaded into the system in future, it can be noted whether the current IPD matches their previously chosen IPD setting. If they do not match, the IPD text will turn red. When they do, the IPD text will turn back to its default white color. The SaveIPD button is indicated below:

c. Calibrating Subject Vision

i. Displacement Filters

Displacement Settings are where each eye camera in VR can be translated along the x, y, or z axis up to + or - some maximum number of millimeters. This can extend either the maximum or minimum IPD by moving the foveal center point past the maximum or minimum physical IPD setting on the hardware device, or compensate for eye deformities where they are positioned beyond normal physical locations. Displacement settings are saved whenever they are changed to the subject’s preference file. Sliders for each eye represent horizontal, vertical, and z depth displacement. Next to each slider is a “VR control” toggle where, if selected, the VR controller thumb pad enables the Subject to move that particular slider back and forth with thumb movements.

ii. Color Filtering

Color Filter Settings enable the User to set a color filter for each or both eyes. The top slider controls the color wavelength in millimeters (approximately - as not all color wavelengths can be replicated on a computer monitor) and the bottom slider intensity in percent. It is theorized that certain color filters may assist Subjects with certain forms of colorblindness, and this functionality allows for experimentation in that regard. When changed the settings are saved to the Subject's preferences. Pressing the lock toggle button on either side of the screen makes the sliders synch to each other so both eyes will be affected at once.

iii. Blur Filters

In Ophthalmologic testing, it is sometimes necessary to obscure detail but not light levels in one eye or the other for testing purposes. With this setting one or both eyes can be "blurred" or put out of focus to a specific intensity. This setting is updated on change and saved in the Subject preferences.

iv. Rotation Filters (Prismatic)

Rotation Settings (prismatic) are where each eye camera in VR can be rotated around the x, y, or z axis up to + or - some maximum number of Degrees (in the display degrees are converted to Diopters). This, like holding prisms in front of an eye, will either simulate a turn or help indicate how much of a turn a patient has horizontally, vertically, and torsionally. Rotation settings are saved whenever they are changed to the subject's preference file. Sliders for each eye represent

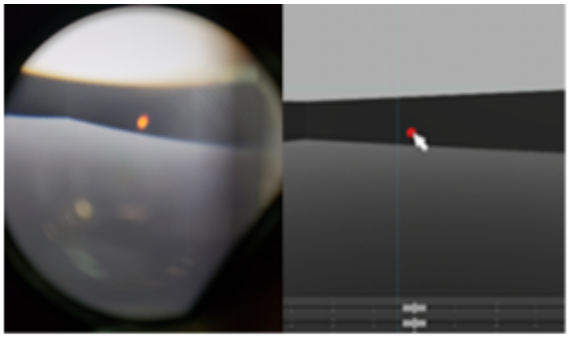
horizontal, vertical, and torsional rotation. Next to each slider is a “VR control” toggle where, if selected, the VR controller thumb pad enables the Subject to move that particular slider back and forth with thumb movements.

d. Basic Tests

i. Eyes on or off

Pressing they Eye toggles (left or right) will toggle the eye on or off, the XX button between them will turn them both off, and if only 1 eye is “on” the >> button below them will swap which eye is currently on with the other. This enables the “Swinging Flashlight” test to be done as long as eye video is available for the User to monitor pupillary response times and the stimulus is sufficiently bright when on.

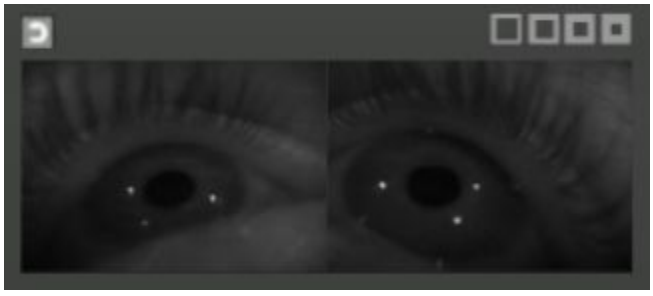
ii. Laser Pointer



Laser pointer in VR and on the Computer Monitor simultaneously.

The toggles directly below the eye are the Laser Pointer toggles. The laser pointer is a small red sphere that tracks with the mouse, and both the Subject and the User can see where it is. It is virtually a few centimeters in front of the Subject's eye, so it can only be shown in either the left or right eye but not both or the Subject will attempt to bring it into focus, which can be very uncomfortable for a stimulus so close to the eyes. By deselecting both sides, the Laser pointer is turned off. Its current setting is saved in the Subject preferences whenever it changes. The Laser Pointer is a very handy communication feature, allowing the User to refer to visually refer to stimulus and help guide the subject to regard elements.

e. Eye Videos and telemetry



If a video stream is available from the eye tracking device, it will be displayed in the eye cameras window above. Pressing one of the 4 buttons in the top right of it will show it at progressively larger or smaller sizes. The refresh button in the middle attempts to reconnect to the video streaming service.

f. Head rotation indicators

There are three windows showing a head oriented straight on, from profile, and from the top down. These show the exact rotation of the head in real time. They can be paused by clicking on them, when they will freeze in place at the rotation when clicked. A small red line in the Y and Z windows shows the relative position of the target test stimulus for reference.

g. Recording Subject Telemetry and video

To begin a recording, press the record button:

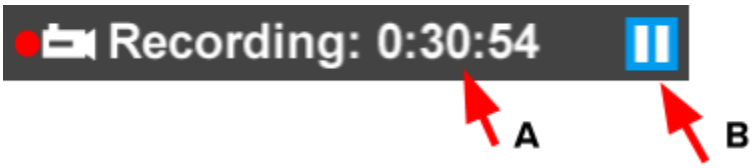
Once pressed a confirmation window will appear to allow the User to confirm they would like to commence recording. On confirmation, the recording interface will appear and the following elements will be recorded:

All UI changes - such as slider positions, toggles, and the object positions and states affected by these value changes. IE if you are

recording and rotate the VR User's camera a few degrees horizontally using the slider, that will be recorded and will appear when played back.

Additionally, the current position and rotation of the Subject's head and controllers will be recorded and will appear as such on playback.

Finally, if available, eye video will be recorded. **Eye telemetry will not be recorded in this version of Evrisia BV1.** Meaning Eye rotation and pupil size. This will be coming in a subsequent version of the software.



A: Recording elapsed time in Minutes : Seconds : Frames

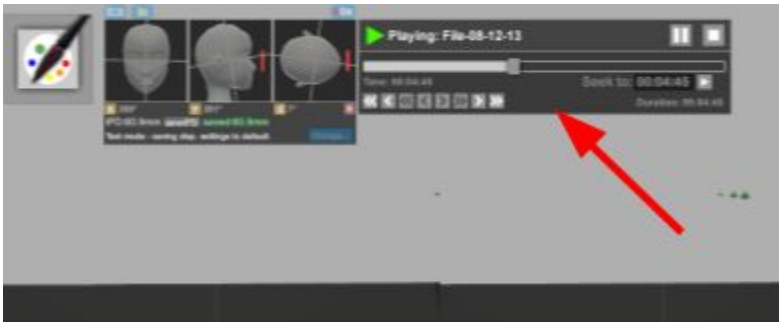
B: Pause / stop control. When pressed, the User will be able to choose to resume recording, delete the recording and exit recording mode, or save what has been recorded up to that time as a file. Saved files will be placed in the current Subject data folder.

h. Playback of Recordings

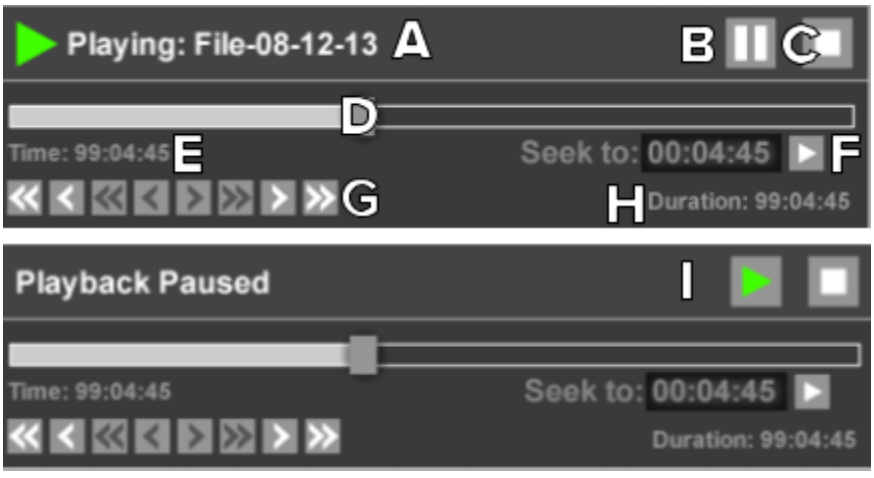
In the subject data file, recordings will be present with the .rec file extension. Opening the folder can be done by pressing the file access button:

Then the Subject data folder will open, and the User can locate a .rec file for playback. If the window is closed and no .rec file is selected, playback will not commence, but if a .rec file is selected, the Program will enter Playback Mode.

Playback Mode will display the following User Interface:



Each of the Playback User Interface Elements function as follows:



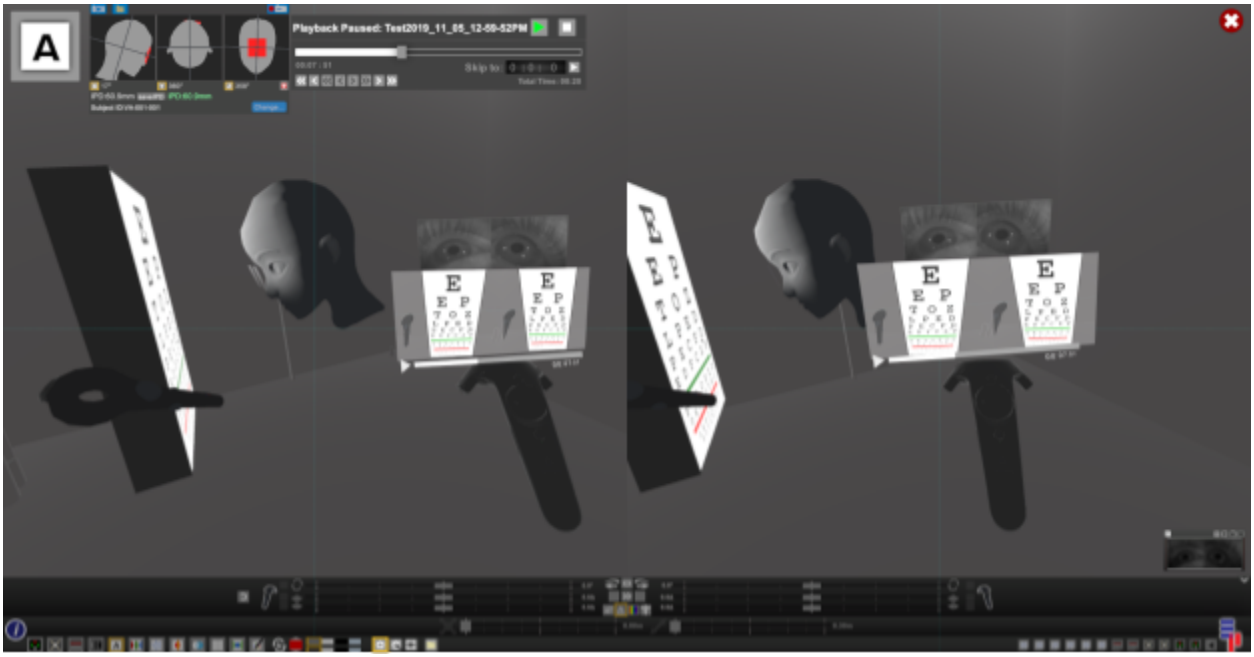
A) Current filename of the .rec file being played

B) Pause button will display pause mode (I)
C) Stop playback and exit playback mode
D) Playback Head. The position of this button relative to the long background rectangle it appears in front of shows the current relative time compared to the overall duration of the file. Clicking and dragging this button will affect the current playback time accordingly.
E) The current time displayed in Minutes:Seconds:Frames
F) Seek to input text boxes. The User can enter Minutes, Seconds and Frames into these boxes and press the arrow directly to the right of them to seek to the indicated part of the .rec file.
G) Precision jump buttons. From left to right they function as follows: Go back 10 seconds, Go back 1 second, Go back 10 frames, Go back 1 frame, Go forward 1 frame, Go forward 10 frames, Go forward 1 second, go forward 10 seconds.

In Playback mode, The User can put the VR headset on and watch the head movement, controller movement, and stimulus objectively. The previously recorded Subject is represented by a 3d head and simulated controllers which will indicate pressed buttons as well as positions based on their state at the current time index.

For control while in VR, the VR controller can control the current position by brushing the thumb left to right on the pad while pressing down (as illustrated below), and the current time will adjust accordingly. Pressing the trigger under the VR controller will pause or resume playback.

VR View of Playback includes seek position and shows perspective of Subject as well as their eye videos if available.



4. Protocols and Protocol Sets

a. What is a protocol?

The protocols are settings of any test, and test parameters that can be accessed with a single click. Protocols appear at the bottom left, and show the Icon of the associated test they will display. Protocols enable the rapid movement through several tests while offering precision and consistency from test subject to test subject. Protocol Sets are groups of protocols.

Simple Protocol Mode:

In simple protocol mode, only the protocols are available and individual settings like stimulus distance, rotation, and other customizations are not available to change. The protocols supplied with Evrisia BV1 have been designed and tested by our expert advisers and it is recommended that most users operate Evrisia BV1 in this mode.

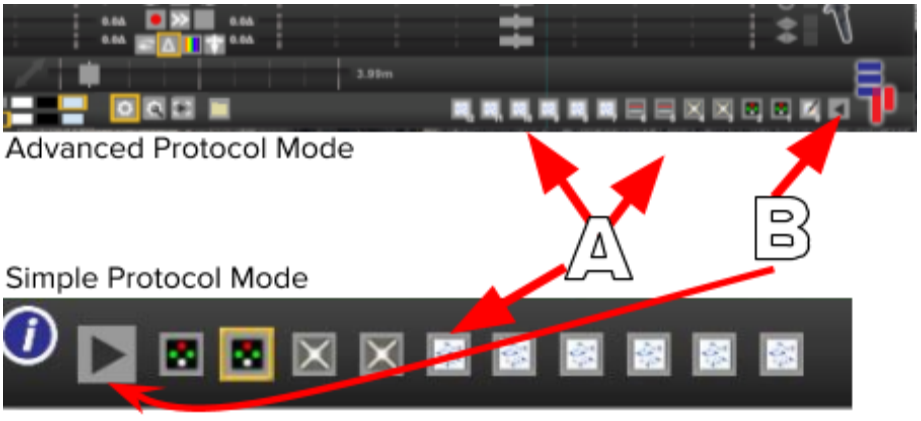
Regular Protocol Mode:

For more advanced users, who may want to deviate from the supplied protocols, once selected, individual settings for a given test can be altered,

and this turns off the protocol highlight if the settings do not match what came with the loaded protocol set indicates. This is recommended only for advanced clinical users who understand the risks associated with altering measurement during assessment.

Authoring Protocol Mode:

For the most advanced users, protocols and protocol sets can be created and edited using the protocol set authoring mode. When this mode is active, changes to the current test settings will be applied to the selected protocol, and then once all the changes to each protocol are acceptable, pressing “S” for save will allow the user to save the protocol set either to overwrite the currently loaded protocol set, or to create a new custom protocol set.



A) The Protocol buttons. A gold frame indicates the currently displayed protocol. If no gold frame exists, current settings do not match any of the protocols.
B) The “next protocol” button. Pressing this will cycle through all the protocols right to left, starting at the first one after the last one has been selected and passed.

b. Protocol Sets

Evrisia BV1 ships with previously designed protocols based on the tests administered by our Ophthalmic advisors.

c. Authoring Protocols and Protocol Sets

Protocols can be edited by entering “Authoring” mode, pressing the  button near the bottom of the UI:

Once pressed, a few different buttons will appear as follows:

A) Load a Protocol Set. This enables the user to load another protocol set or reload the current one.

B) Save Confirm. When confirmed, the external protocol file will be overwritten with the currently set protocol settings on all of the protocols. Cancelling the save returns the user to previously set protocol settings.
C) Return to Regular Protocol Mode from protocol authoring mode. This is for when editing is completed.
D) Record current settings to the selected protocol. This may be redundant as settings are continuously written to the selected protocol whenever any protocol related settings are changed.
E) Add a new protocol. Pressing this button will add a “blank” protocol that will accept whatever related settings are set. It can be saved and updated as well.
F) Protocol buttons. Note they indicate their order in the bottom left of each icon and which test they represent with their icon. As shown many protocols can be the same test only with different test settings.
G) The currently selected protocol is the one being altered by the changes of test settings. If no protocol is selected, no changes will be applied to any protocol.
H) Protocol Delete button. Pressing this button will delete the currently selected protocol.

5. Available Tests

a. Introduction to the tests

The tests below consist normally of some kind of visual stimulus that is based on one or more of the Gold Standards in Ophthalmic testing. The stimulus can normally be “Attached” to the head rotation or not attached, depending on the test requirement, but the stimulus will normally always move with the position of the Subject’s head. If attached using the rotation lock button, the stimulus will always appear directly in front of the Subject’s face at the exact specified distance no matter where they turn their head. If

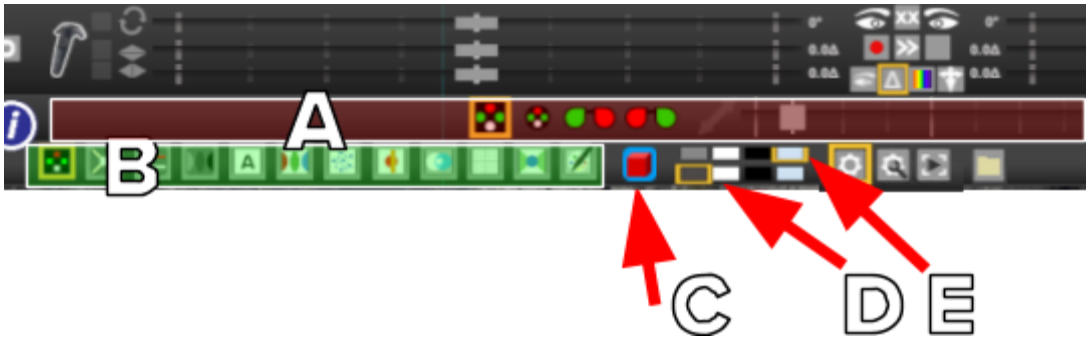
not, it will still remain the specified distance but not necessarily in front of the Subject's face.

Each test is represented by an Icon that is the button graphic, but also will appear in the top left of the user interface, and as the current protocol if the given test is the one also displayed by the protocol.

Test settings all appear in the part of the interface that is directly above the Test and Protocol Selection buttons, but directly below the Subject Visual Settings controls.

b. General Settings

These settings are what are recorded by the Protocols and relate to what stimulus needs to be presented to the Subject to conduct the given test.



i. Test specific Settings

(A)These settings will change depending on which test is selected. Settings for each test will be described in detail below.

ii. Test Selection

(B) These buttons indicate what tests are available and which one is currently selected.

iii. Test Stimulus Settings Window Launch.

(C) This opens the Test Stimulus Settings window, which allows you to select the position and rotation of the test stimulus relative to the Subject's head in any or all three axes (x,y,z rotation and position)

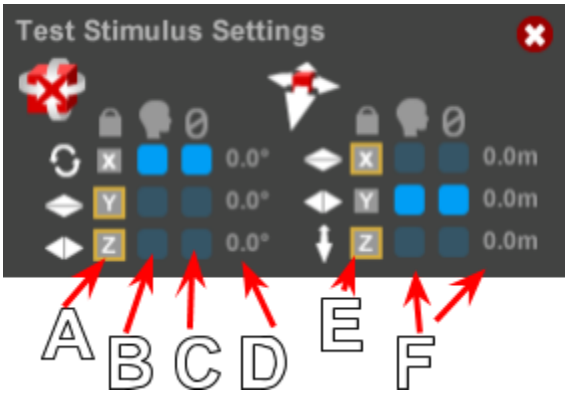
iv. Room Colors

(D) The color of the "Room" or Virtual walls, floors and small objects apparent in the Room. If none of these are selected there is no room displayed, IE no walls, floor, or objects. Only the Skybox will appear.

v. Skybox Colors

(E) The color of the "Skybox" or distant sky and horizon at infinity. This represents the inside of a giant sphere at visual infinity where the subject is effectively at its center. This sphere cannot be turned off, but it can appear totally black or totally white rendering it non-apparent.

c. Test Stimulus Settings



(A) Select these to lock or unlock rotation synchronization between the Test Subject's head and the Test Stimulus itself.

(B) If rotation synch is off, then you can press this button to match the rotation of the subjects head in the corresponding axis (x, y or z).

(C) If rotation synch is off, then you can press this button to return the Test Stimulus itself back to its default value (zero degrees).

(D) This text indicates the current rotation of the test stimulus relative to the Test Subject's head. This updates whenever the value changes.

(E) These Displacement toggles work the same as (A), but with Displacement (position) instead of Rotation.

(F) These buttons are available when the Displacement toggles are off, and the text updates in meters vs degrees for the corresponding text items in the rotation section.

d. Worth 4 Dot

The Worth 4 Dot test is for the assessment of eye function. Two different stimulus, a larger square and a small flashlight sized one, are shown to a patient while they are wearing red and green filters over their eyes.

(A) Large stimulus selection

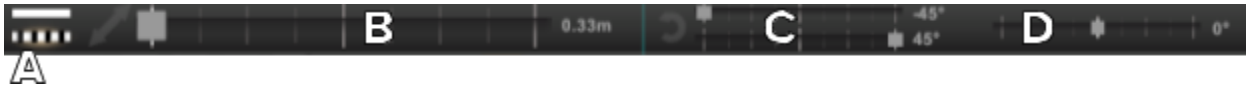
(B) Small stimulus selection

(C) Turn filters on, left green right red, or vice versa. Selecting none turns them off entirely.

(D) Slider control to vary the distance of stimulus in meters, with current distance indicated at the far right.

e. Bagolini Striated Lens

The Bagolini Striated Lens test shows two beams or white rods of light crossed at 45 degrees perpendicular to each other. One beam is shown in one eye only, and the other beam is shown in the other eye. Beams can be individually rotated torsionally.



(A) Choose Gradations or not on each of the white rods

(B) Slider control to vary the distance of stimulus in meters, with current distance indicated at the far right.

(C) Sliders to control the angles of the individual rods. Default is 45 degrees plus and minus respectively. Angle in degrees is indicated to the right of each slider.

(D) Slider to control the rotation of both rods together. Default is zero degrees. Degrees of rotation are indicated to the right of this control slider.

f. Double Maddox Rod

This test shows one red horizontal rod, and one white horizontal rod in each eye respectively. The Subject is asked what the correct rotation of one of the rods to make it perfectly parallel to the other rod to indicate Torsional rotation of their eyes.

(A) Which rod is to be controlled by the Subject using the VR Controllers. Pressing the trigger on the VR Controller will rotate the selected Rod clockwise or counterclockwise.

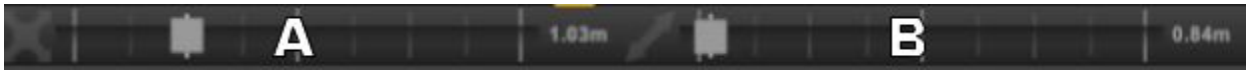
(B) Sliders to show or perform rotation of the Red or White rods by the User.

(C) Pressing this button will reset rotation of both rods to zero

(D) Slider to change the distance of the stimulus. Distance in meters is indicated on the far right.

g. Visual Acuity

This is a typical letter based eye chart to help determine visual acuity.

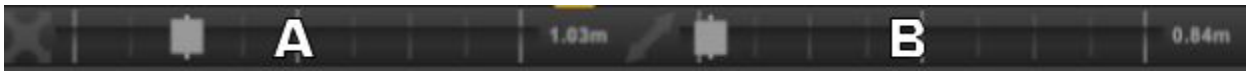


(A) Slider that controls the size of the visual stimulus, with height in meters indicated to the immediate right.

(B) Slider that controls the distance of the visual stimulus, indicated in meters to the immediate right.

h. Contrast Sensitivity

A typical chart to show letters that vary from high contrast to minimal contrast. The subject will attempt to identify all the letters on the chart while standing in normal lighting conditions.



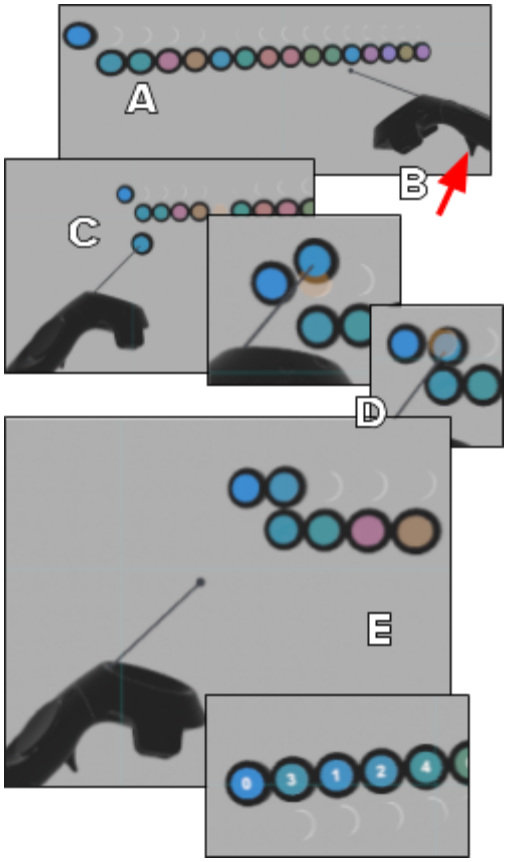
(A) Slider that controls the size of the visual stimulus, with height in meters indicated to the immediate right.

(B) Slider that controls the distance of the visual stimulus, indicated in meters to the immediate right.

i. Farnsworth Panel D-15

This is a color sensitivity test where the Subject is presented with several discs at varying hues. They are asked to arrange the discs in order of hue, starting with a particular one, placing discs in order of similarity to the original hue from left to right.

In VR, the Subject will see the normal controllers and the color discs in a row with their order set at random. Using the VR Controller, they will need to put the end of a small rod “inside” each disc, press the trigger to “pick it up” and then drop it on the semi transparent disc in the row directly above it.



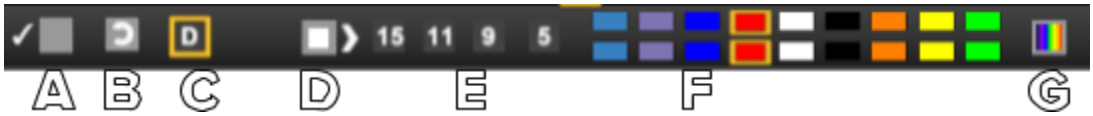
(A) Colored Discs presented in Virtual Reality for the Subject to select and move by pressing the trigger button (B)

(C) While holding the trigger button down, the Subject moves the tip of the rod at the end of their controller into a disc, and it will attach as pictured.

(D) moving the disk to a semi transparent target in the row above, try to match the disc to the left as closely as possible.

(E) All the discs may be placed in this way. The actual numerical order of the discs can be displayed at any time (as described below)

The Farnsworth Color Test also has a custom/advanced setting that allows for the selection of specific start and end hues, or to display a spectrum cube graphic for further color assessment. It is possible to try using the general color filters settings as described above to see if some color filtering improves hue selection or not.



(A) Show or hide the hue order numbers

(B) Refresh/reset the test.

(C) Select the standard D-15 test

(D) Select “advanced” color test controls (everything that appears to the right of this button will appear or disappear depending on the state of this toggle button)

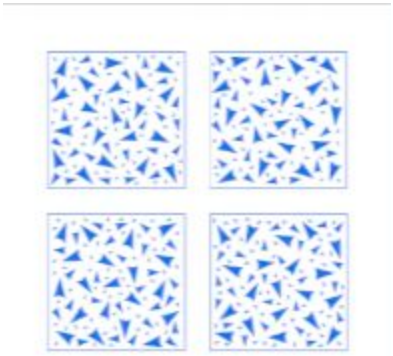
(E) Select the number of color discs.

(F) Select the start and end color of the hue range. The mitigating colors will be calculated mathematically between those two extents.

(G) Show or hide the full spectrum cube.

j. Frisby Stereopsis

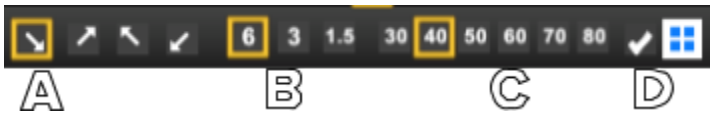
The Frisby Stereopsis test helps identify the Subject’s depth perception ability using only the difference in location between their two eyes. It endeavors to remove all monocular cues such as size differences, lighting cues, and visual occlusion. It shows four different patterns with one part of one of the patterns slightly closer to the Subject than the rest of the patterns.



Pictured is the Frisby Stereopsis test, when viewed monocularly, it should be impossible to tell which part of which square is closer than the rest.

Here in a closeup, monocular cues indicate that the center of one of the squares is standing out, including color difference, occlusion, and an oblique angle for view. These are the kinds of things that the test endeavors to overcome.

Frisby UI



(A) Arrow toggles indicating which of the 4 tests will have the stimulus part that is closer to the Subject.

(B) The distance in mm the closer stimulus part is compared to the rest of the test stimulus.

(C) The overall distance of the stimulus, in cm.

(D) Whether or not the overall stimulus is visible. It is a best practice to leave this toggled off until the other settings have been set, as switching between settings while the stimulus is visible does provide some monocular cues as well.

k. Brock String

This test simply shows a small gold bar at close proximity to the Subject, and a large red sphere some several meters away from the subject. If the IPD settings are correct and stereopsis is possible for the subject, converging on the small gold bar will make it appear there are 2 red spheres. Conversely if they converge on the red sphere, two gold bars should be on either side of the sphere.

l. Synoptophore

The Synoptophore is a large, complex device that displays a slide in each eye of the Subject. The slides can be translated horizontally, vertically, and depthwise, as well as rotated horizontally, vertically, or torsionally. The subject can move the slides until they match a certain

criteria, such as a lion in the left eye appears in a cage displayed in the right eye. Some of the slides, when shown together, will appear to show depth or stereopsis, like part of the slide image is closer or farther away than the other. The idea is that the slides can be moved until the user manages to achieve stereopsis, and then the settings can determine what kind of corrective prism or surgical re-orientation of the eye the subject may require.

(A) Flip either the left or right slide horizontally. When off they are each in default position

(B) Reverse slides so Default left is in the right eye and the converse is true as well.

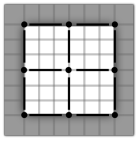
(C) Choose a black or white background for the slide

(D) Choose which slides to display.

(E) Set the distance

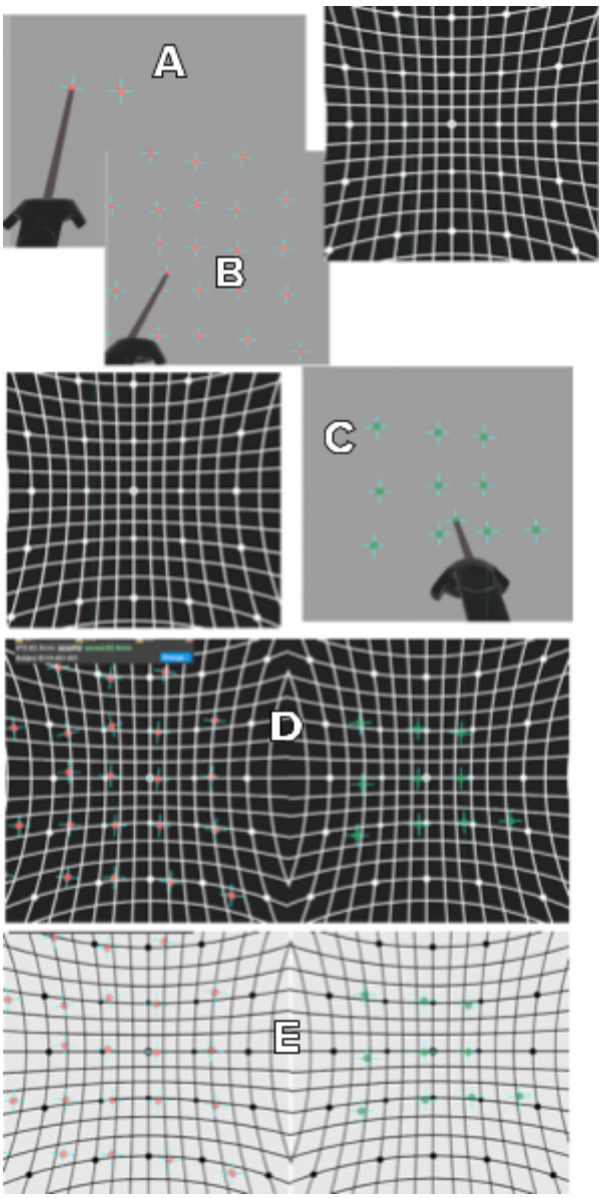
Note: To properly carry out this test, use of the Rotation Filters (Prismatic) is required along with the VR controllers as indicated so the user can move the sliders like they would on a physical Synoptophore.

m.Lees Screen / Harms Test



This test displays a screen with small circular targets in one eye, and allows the Subject to point where the targets would be if the screen was in

that eye as well. This helps determine discrepancies between the visual field, especially when the eye is at its extreme extents (looking hard to the top and bottom corners for example) The test tends to be less effective for torsional comparisons between each eye, but the Evrisia BV1 version captures torsional rotation as well as position of the targets.



(A) Subject positions red targets by moving the VR controller to the parts of the grid where small circles appear to them in the opposite eye to the controller. Pressing the trigger places a target at the x, y and torsional rotation they desire.

(B) When finished the eyes can be switched

(C) The opposite eye uses a different color target but works the same way.

(D) When both eyes have been completed, the test reveals where each side of targets were placed in each eye, and the results may be analyzed.

(E) At any time during or after the tests, the colors can be swapped from black background/white grid to white background / black grid.

The UI for the Lees Screen/ Harms test:

(A) Undo/Redo last placed target.

(B) Delete All Targets (cannot be undone)

(C) Distance / scale option. By default the screen stimuli is approximately .75 meters away from the eye and about 1 meter square. The small square icon here indicates the toggle that will place the object 3 meters away and make the screen large enough to look the same size in the visual field as it does when close. This is an experimental feature.

(D) Select the target eye (or none when the test is complete to view all the targets from both eyes)

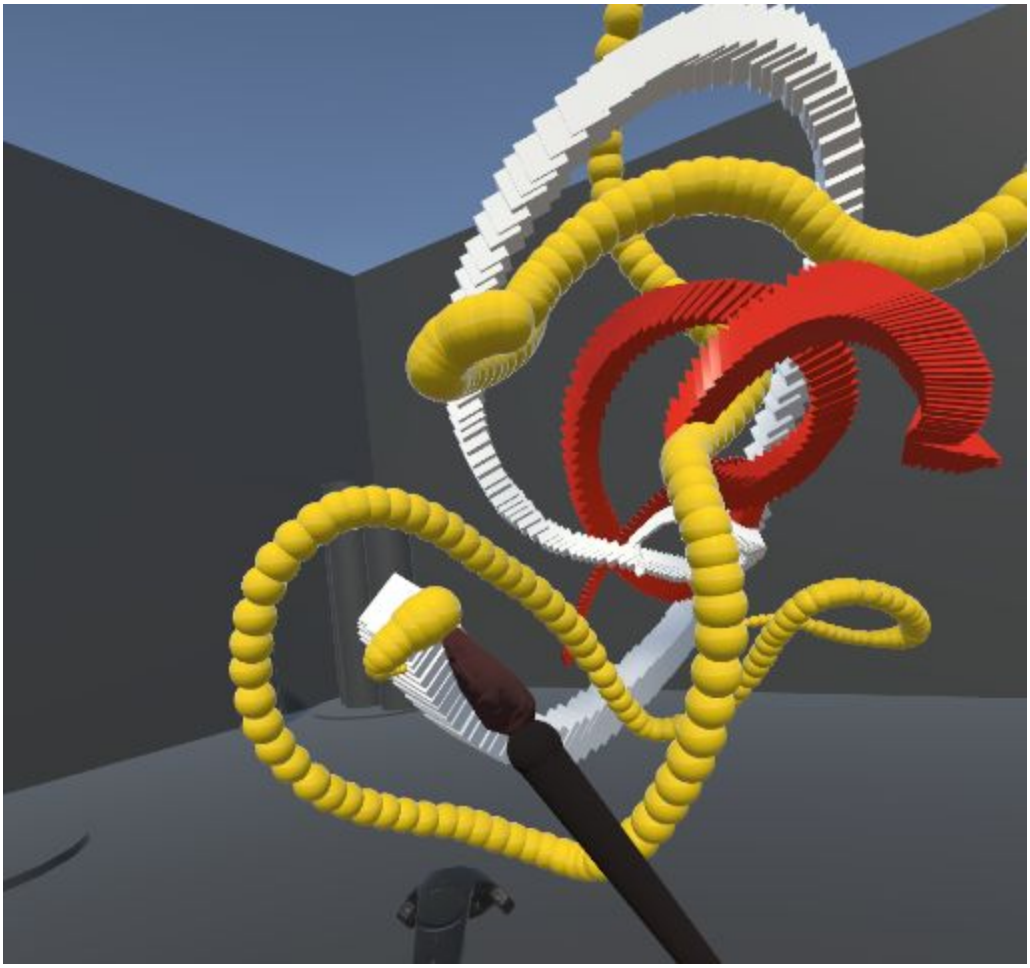
(E) Choose the colored background for the test.

Note, once both tests are complete, it is recommended to display all the targets and then take a screenshot immediately so the record of performance for the Subject is retained.

n. Visual Field Test

This test is not currently available but will be as hardware capabilities come online to make it feasible.

o. Evrisia Art

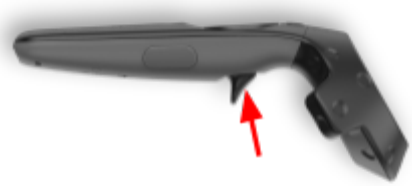


Spending a little time being creative can be a great way to introduce someone to Virtual Reality who hasn't been in it before. In our experience, the act of creating objects in Virtual Reality gives the Subject a sense of environmental control, which tends to put them at ease. We are exploring

whether this activates the parasympathetic nervous system, making the Subject more receptive to the tests that follow.

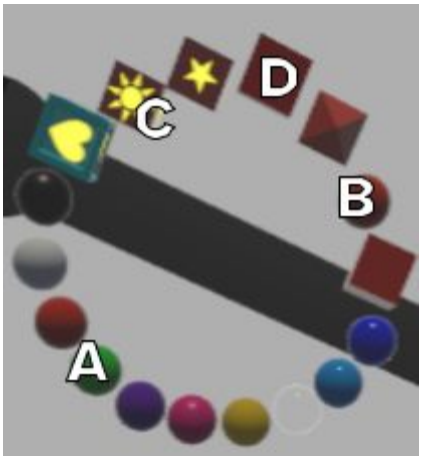
Grip Button: Pressing the Grip buttons on the side of the VR controller switches the VR controllers to change from their default shape into virtual paint brushes. Pressing them again toggles the controller back to default mode.

Trigger: With a controller in paint brush mode, the Subject can place 3d shapes anywhere in their environment by pressing the trigger. The amount of pressure on the trigger impacts the size of “painted” objects, the lighter the pressure the smaller the object.



Thumb Pad: Clicking the thumb pad on the top of the controller makes all shapes painted by that controller drop to the ground. One more click and they all animate back to where they were.

Paint Brush Mode: While in paint brush mode, brushing the pad (not clicking) with the thumb and moving it around will allow the Subject to pick a color, shape, and particle effect for the objects they “paint” around their environment.



(A) Color selection. Drag the thumb to one of these to pick a color. Once selected the shapes (B) will become that color as well as the painted objects.

(B) Shapes, pick one of three possible shapes by brushing the thumb to this part of the menu.

(C) Particle effects. Chosen particle effect will gain the blue “cube” style frame around it.

(D) Deselect particles. Choosing this will cancel particles for that brush.

Particle effects are tiny 2 dimensional shapes that appear to “spray” out of the painted shapes. There are 3 available particle effect styles.

Clicking the grip buttons to return to default mode makes the controller able to grab objects using the trigger. One controller could be made a brush, and the other in default mode, and in this way, painted objects can be created by one hand and moved by the other.

Note, to save memory, there is a maximum number of “shapes” one can create while painting. When the trigger is pressed and while its held down, shapes will appear, but as soon as the maximum is hit the first shape created will disappear, and so on, as new shapes are painted they take the place of the earliest shapes created, almost like a snake effect. Once the trigger is released, the group of shapes created by that trigger press/hold/release moment become a “Stroke”. The strokes operate similarly in that once too many strokes exist, new ones will replace the earliest ones. In default mode, the controller moves “Strokes” not individual shapes.

Evrisia Art UI

(A) Disallow particles

(B) pick Default Controller or PaintBrush

(C) Delete all particles and shapes drawn by this controller

(D) Drop shapes, or animate all of them back into place (drawn by this controller)

(E) Allow Subject to drop shapes

(F) Allow Subject to draw particles

(G) Turn off the Art Floor and Walls (this “floor” catches the dropped particles. If floor is off, drop is automatically disabled on both brushes)

(H) Choose Art Floor and Walls color.

(I) These buttons affect the opposite controller. See A - F above.

Note: In the main UI, an image of the controller will appear above the buttons if the controller is active and tracking. It will change to a paintbrush if the corresponding controller is switched to paint mode, and back to a default VR controller if it is in default mode.