Virtual Reality Laboratory in the Munroe Meyer Institute

cometrics

v1.3.1 User Guide

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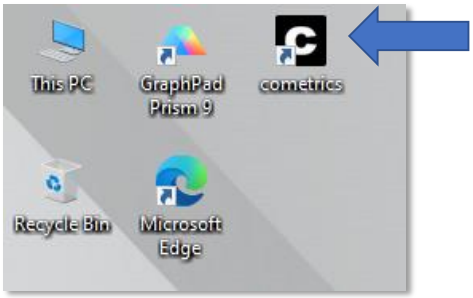
8-4-2022

Contents

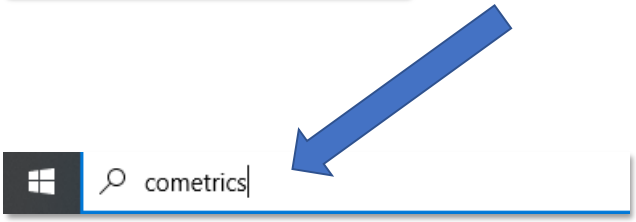
Section 1 Open Program

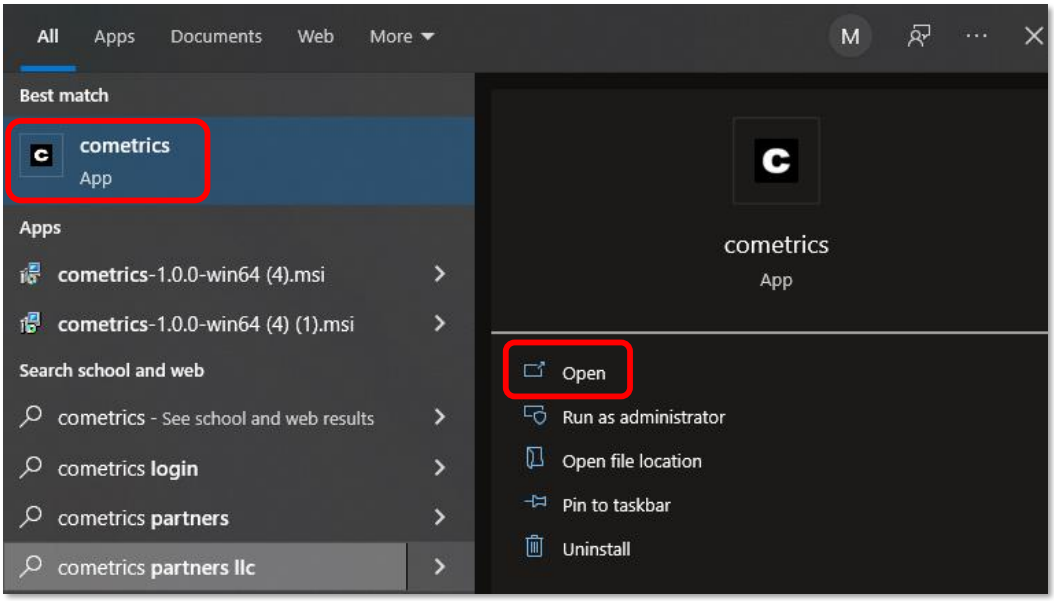


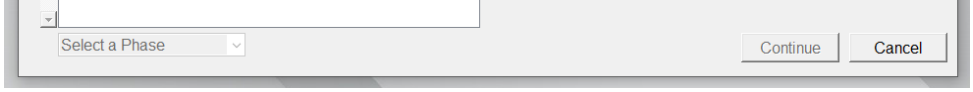
- Locate the **cometrics** icon on desktop

OR

- Search "**cometrics**" in the Windows search bar (bottom left of screen)

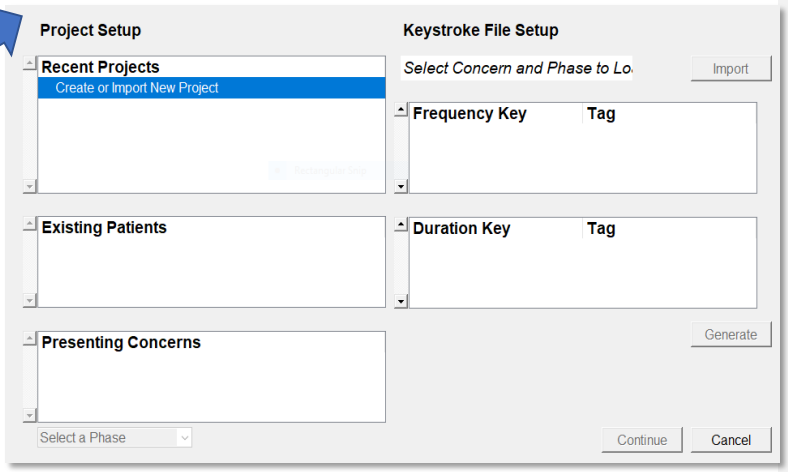






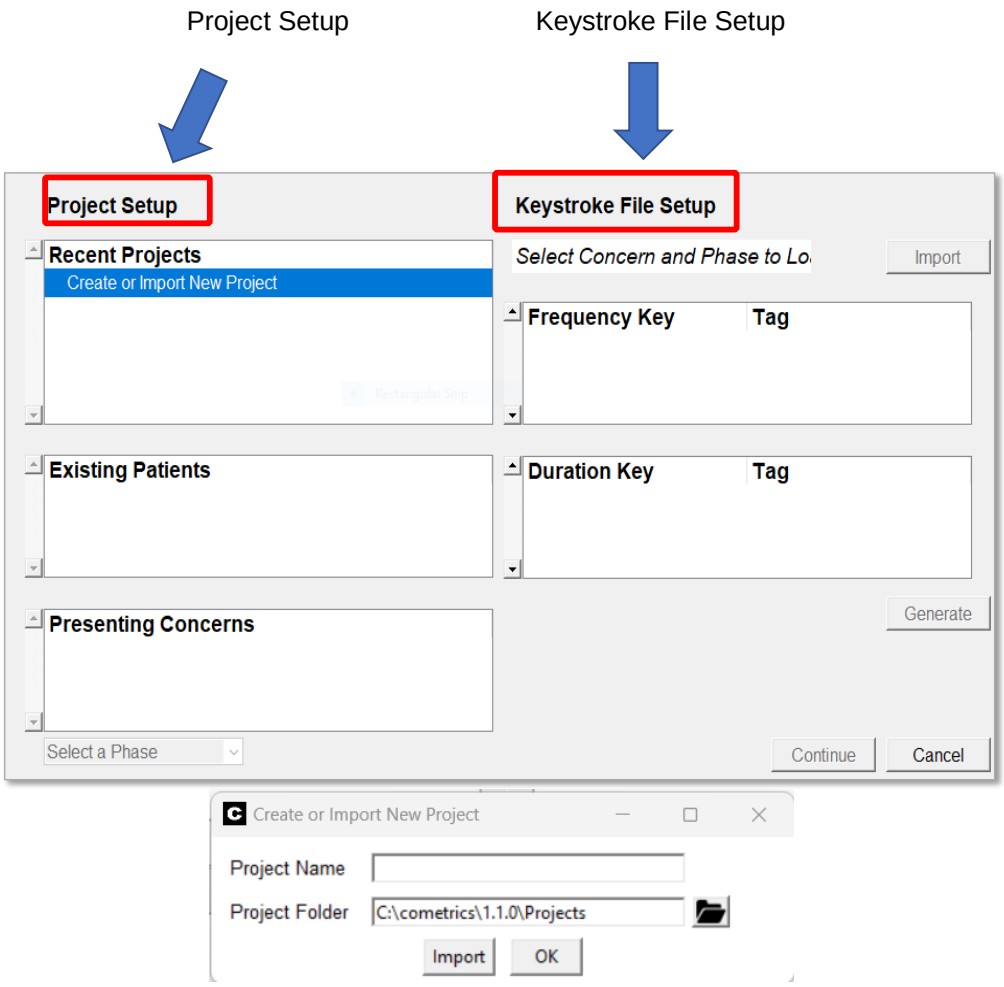
Section 1 Open Program

Start Menu will open



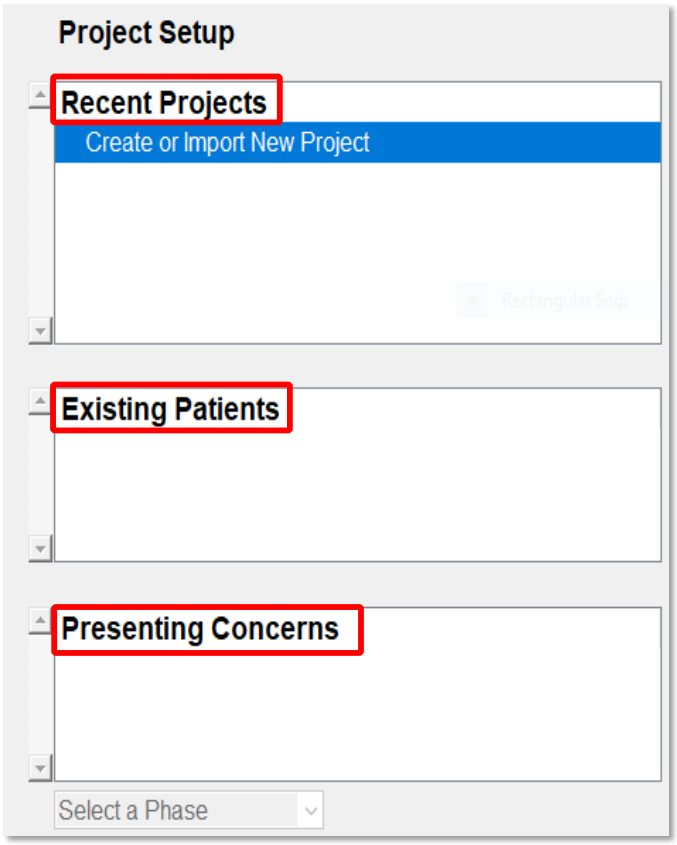
Section 2 Start Menu

Two Sections of Start Menu:



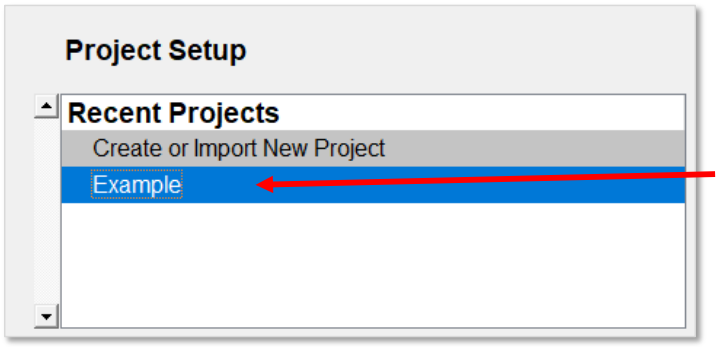
Pressing **Create or Import New Project** will open the above window.
The default save directory can be changed using the folder icon.
Existing projects can be imported using the **Import** button

Section 3 Project Setup

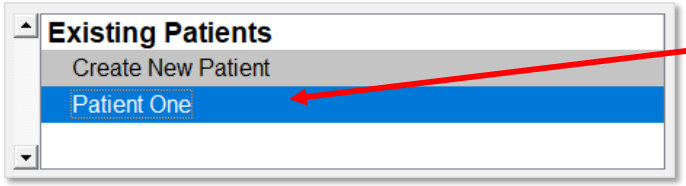


- **Recent Projects** tab is used for creating and importing projects
- **Existing Patients** tab shows which patient is being studied in each session
- **Presenting Concerns** tab shows what behaviors are being recorded / analyzed in the session

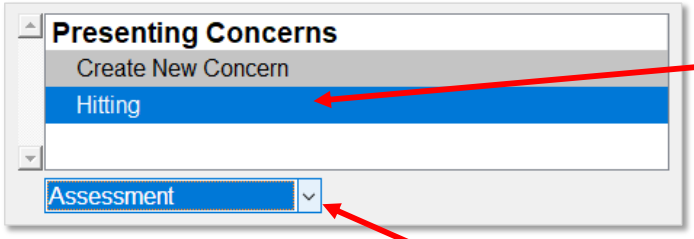
Section 3 Project Setup



1) Create or import the session you wish to work on
    a. Right clicking a project will delete the project from the list



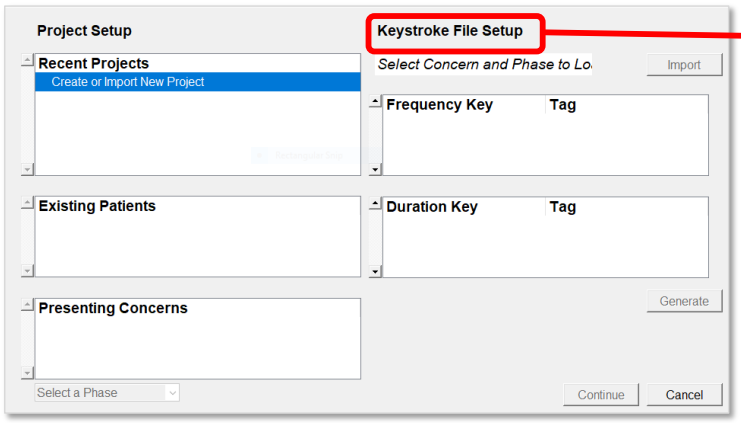
2) Create or select the patient being assessed



3) Create and add the presenting concerns in the session

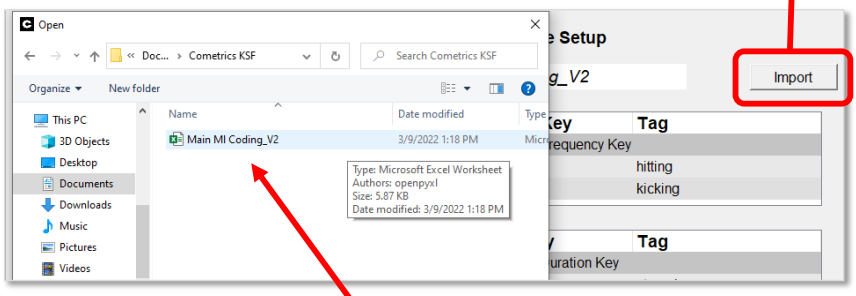
4) Select whether this is an **Assessment** or **Treatment** phase

Section 4 Keystroke File Setup



- **Keystroke File Setup** is used to assign behaviors to keys when coding

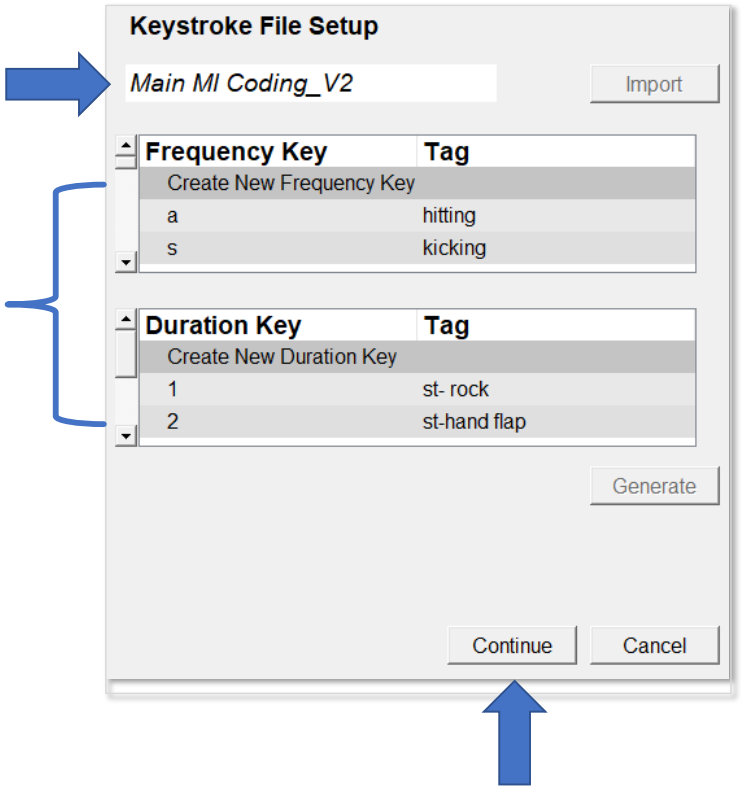
- This is done by **importing** an Excel spreadsheet associated with these codes



- If a file is not already uploaded, press **Import** to find and select the Excel file you wish to use for coding

Section 4 Keystroke File Setup

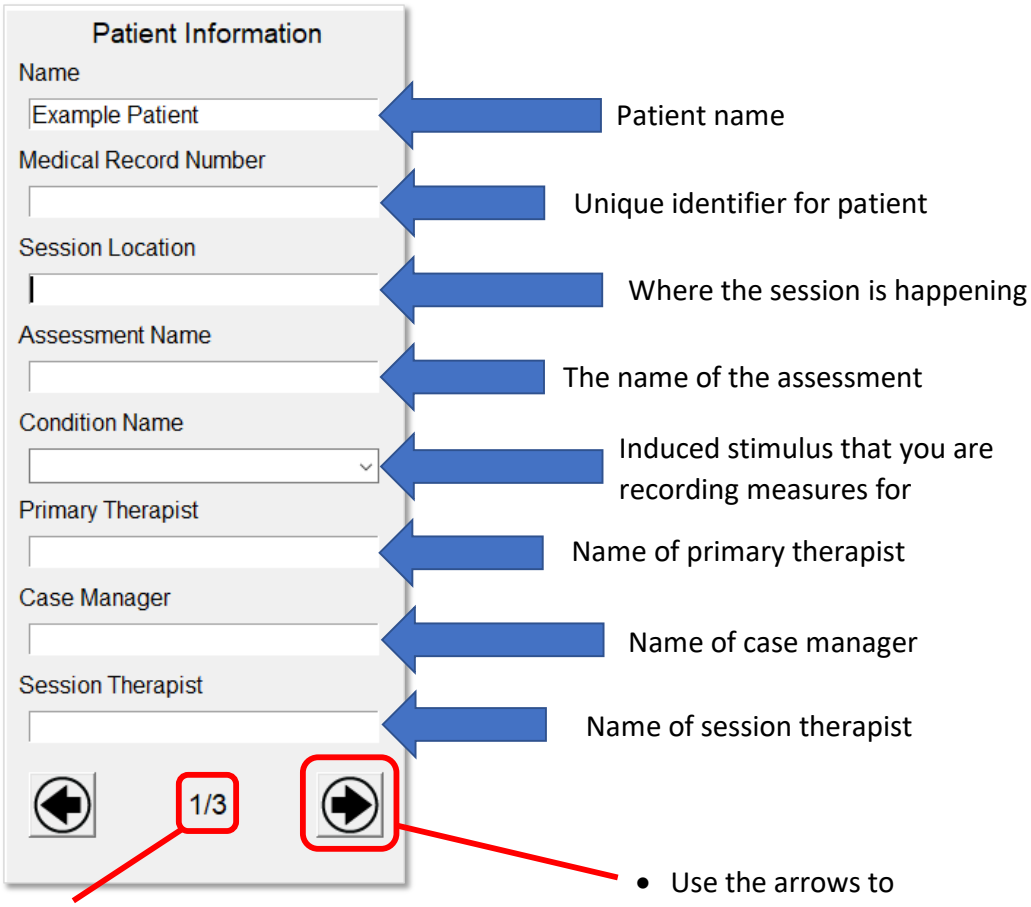
- Name of the selected Excel file
- Preview of the coding keys in the Excel file



- Select **Continue** in the bottom right to begin coding

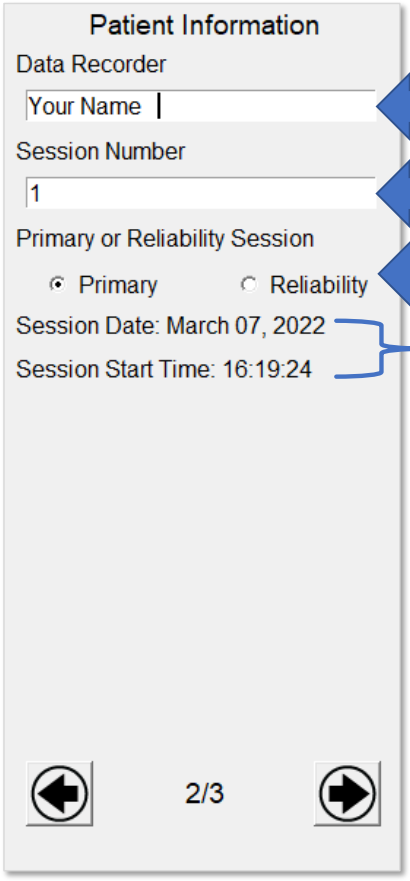
Section 5 Patient Information (Page 1)

NOTE: You will **not** be able to begin coding until <u>all sections</u> of **Patient Information** are complete (error messages will occur until the spaces are filled)



- There are 3 **Patient Information** tabs
- Use the arrows to navigate the **Patient Information** tabs

Section 5 Patient Information (Page 2)



Name of the person coding the video

Identifying number for the session

Select if this is a Primary session (patient video) or a Reliability session (test for coder accuracy)

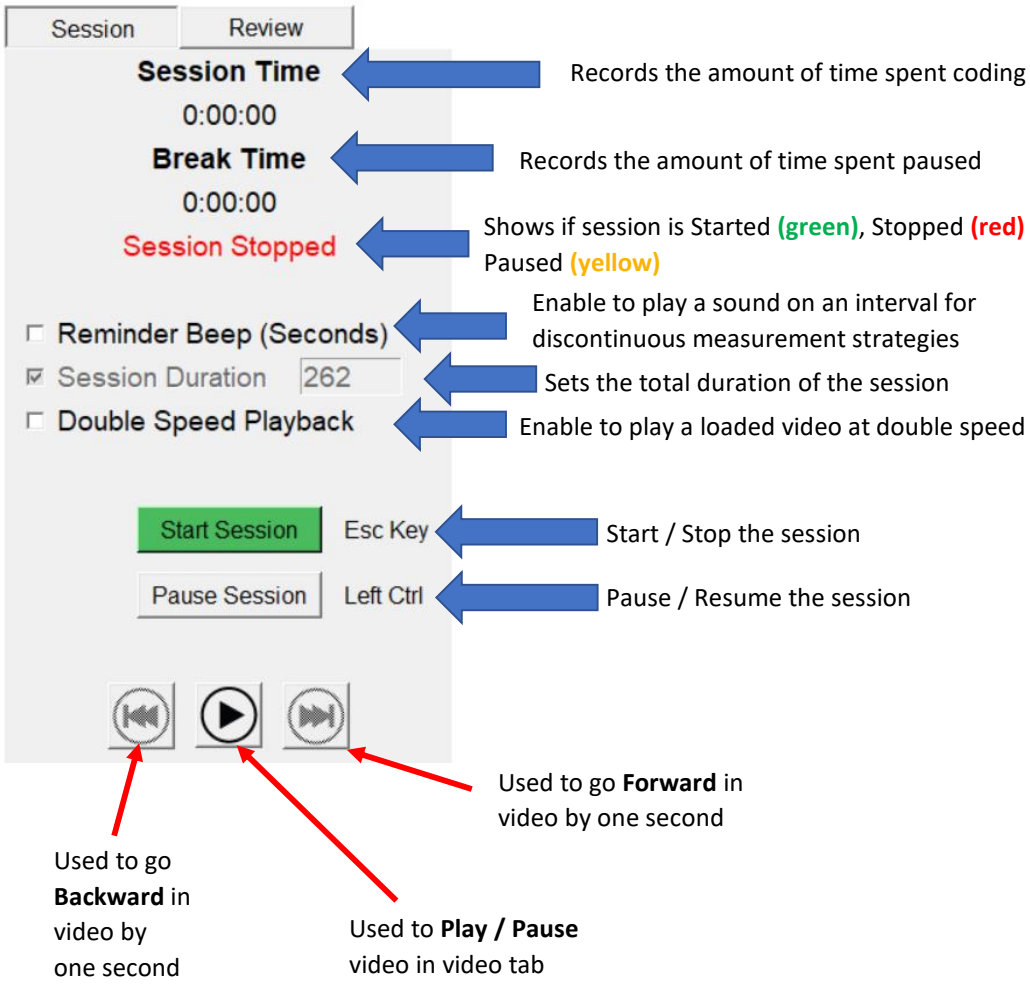
The date and starting time of the coding session

Section 5 Patient Information (Page 3)

Page 3 of the **Patient Information** tab lists the keyboard characters assigned to each behavior tag

This will be automatically shown when the session is started

Section 6 Session Times



Records the amount of time spent coding

Records the amount of time spent paused

Shows if session is Started **(green)**, Stopped **(red)** or Paused **(yellow)**

Enable to play a sound on an interval for discontinuous measurement strategies

Sets the total duration of the session

Enable to play a loaded video at double speed

Start / Stop the session

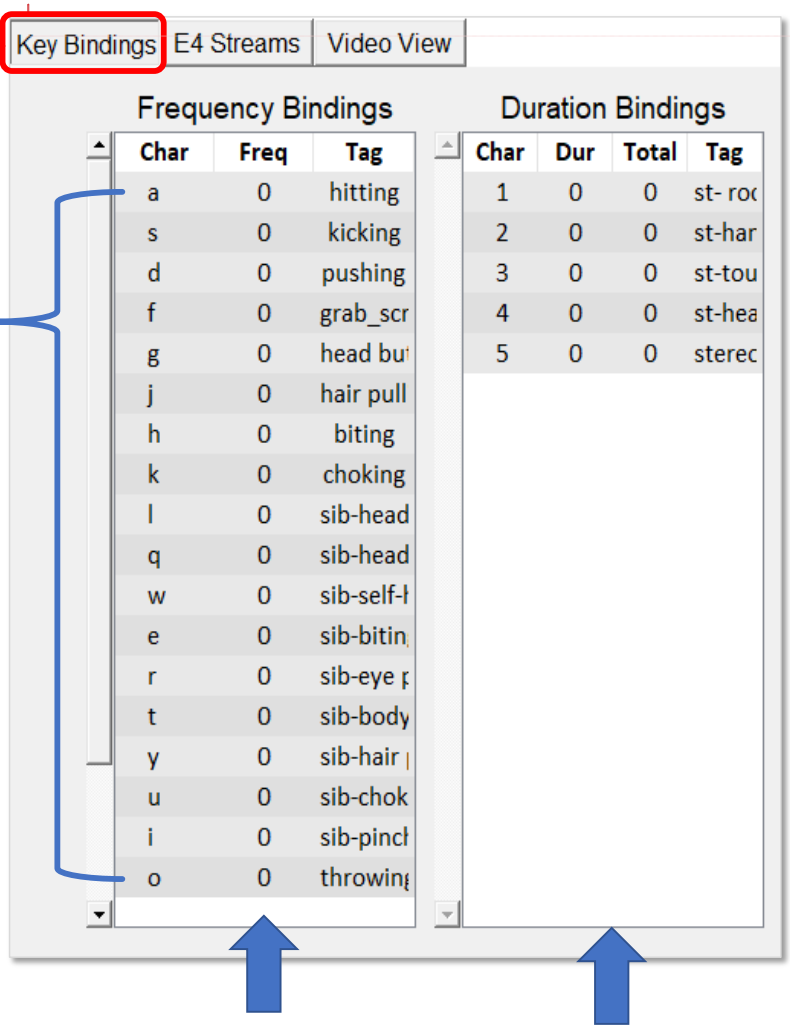
Pause / Resume the session

Used to go **Forward** in video by one second

Used to go **Backward** in video by one second

Used to **Play / Pause** video in video tab

Section 7 Key Bindings



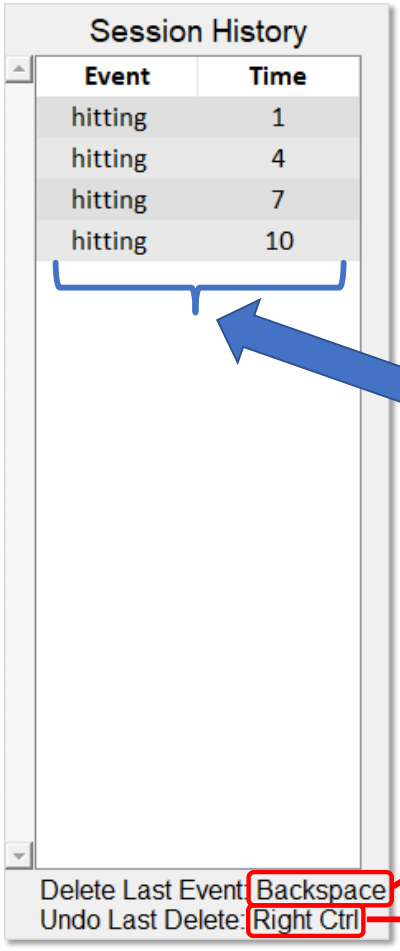
- The **Key Bindings** tab shows the **characters** tied to each behavior

- The **Frequency** column shows the number of times a code has been used in the session

- The **Dur** and **Total** column records how long a code has been active per activation and per session, respectively

Commented [w1]: Add some details about the session history and the commands for it.

Section 7 Key Bindings



- The **Session History** tab gives a basic view of what codes have been used and the time (in seconds) at which they occurred

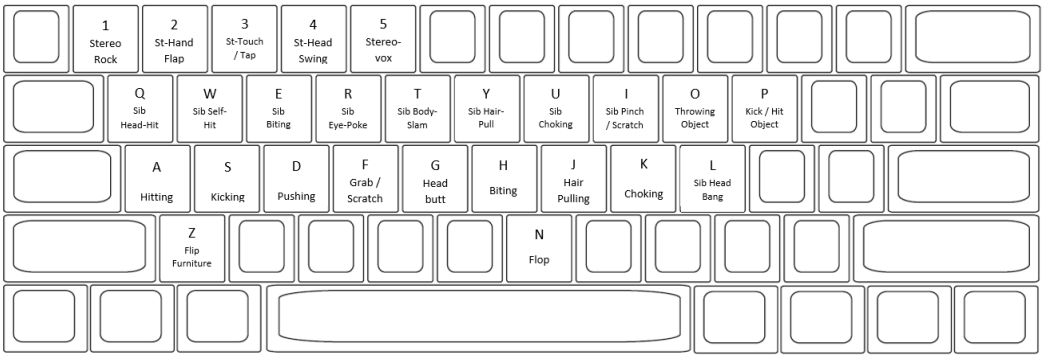
- The **Event** and **Time** columns show what behaviors have been coded during the session and at what time they occurred, respectively

- Press **Backspace** to delete the last coded event

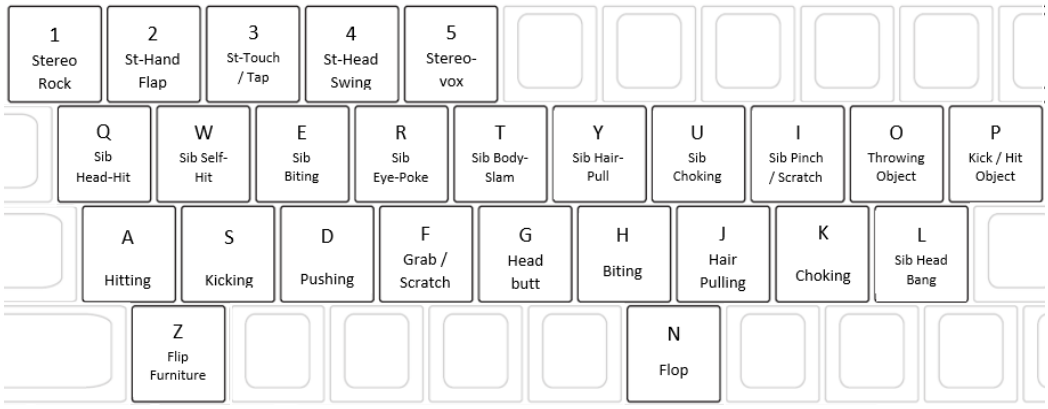
- Press the **Rightmost Control** key to undo the last deleted event

Section 7 Key Bindings (Keyboard)

Keyboard Codes



Keyboard Close Up

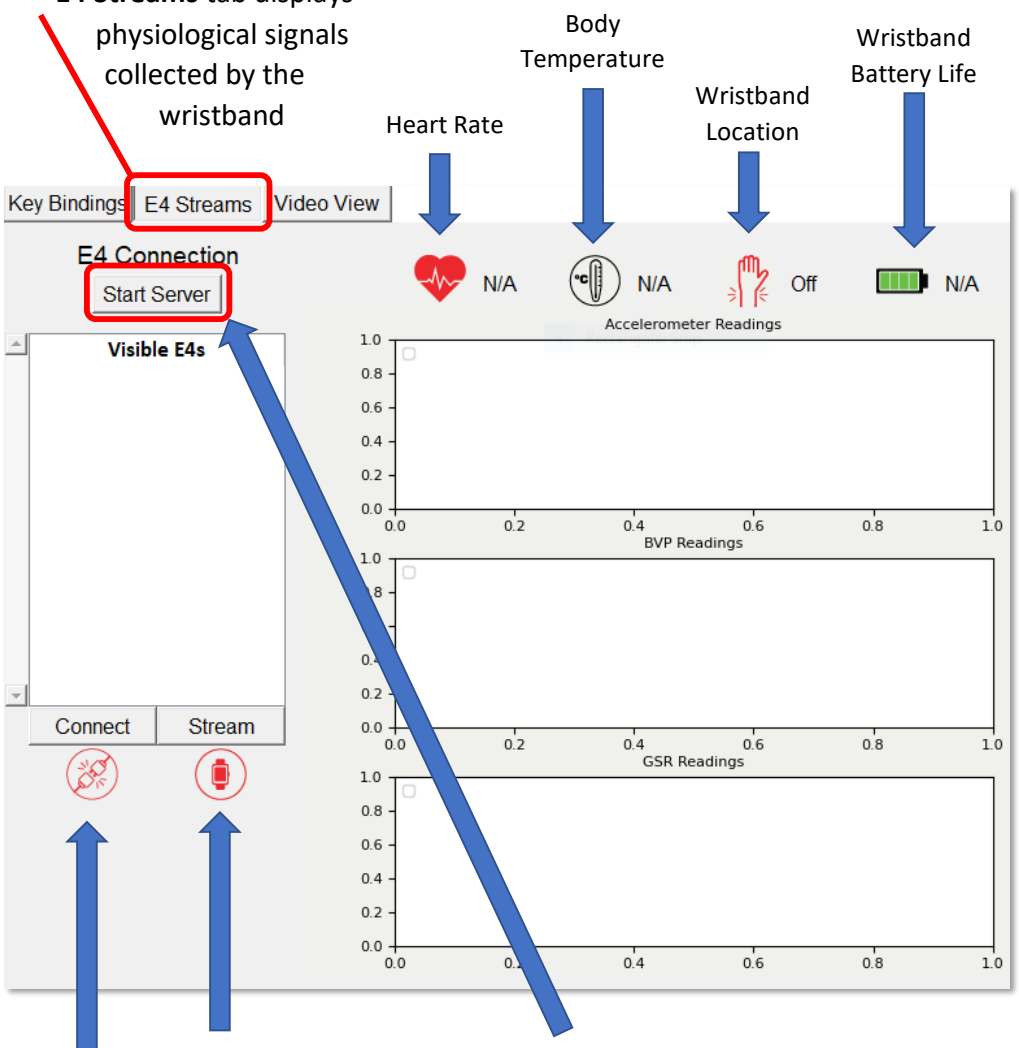


For exact descriptions of each behavior, see **Operational Definitions document

See the **Coding Cheat-Sheet for simplified descriptions of the behaviors and their keys

Section 8 E4 Streams

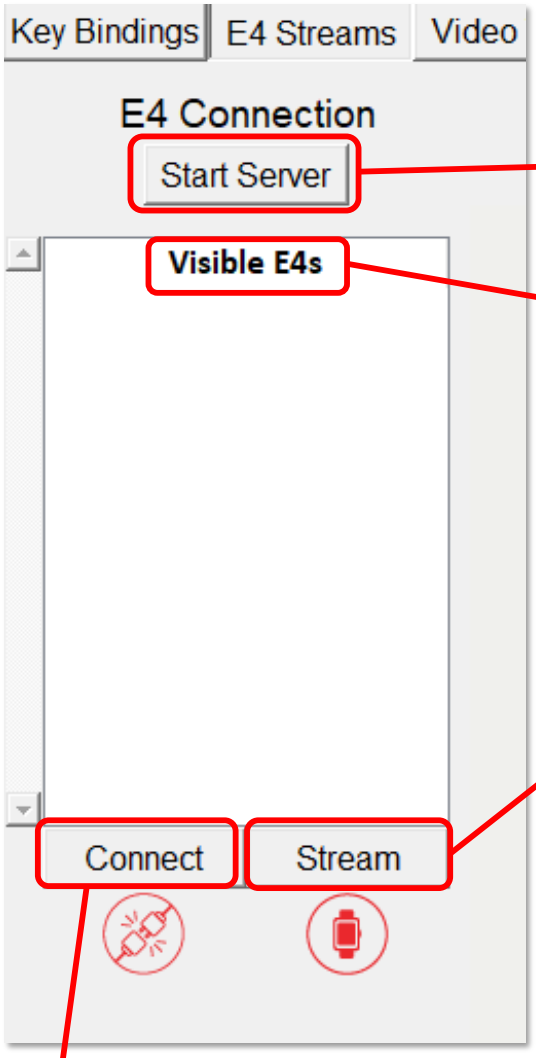
- **E4 Streams** tab displays physiological signals collected by the wristband



https://developer.empatica.com/windows-streaming-server-usage.html

To connect an Empatica E4 to cometrics, setup the Streaming Server as described in the above link before pressing “Start Server”

Section 8 E4 Streams



Press **Start Server** to begin utilizing the E4 wristband

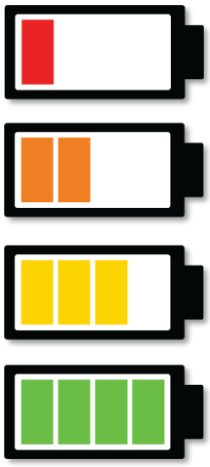
The **Visible E4s** tab shows the available wristbands that can be used to stream data

Select **Stream** to start streaming the data from the wristband to the cometrics program

Select **Connect** to connect the wristwatch to the cometrics program

Section 8 E4 Streams (Icons)

Battery Life



≤ 25%

≤ 50%

≤ 75%

≤ 100%

Wristband Location

Wristband **on** arm

Wristband **off** arm

Streaming Status

Streaming

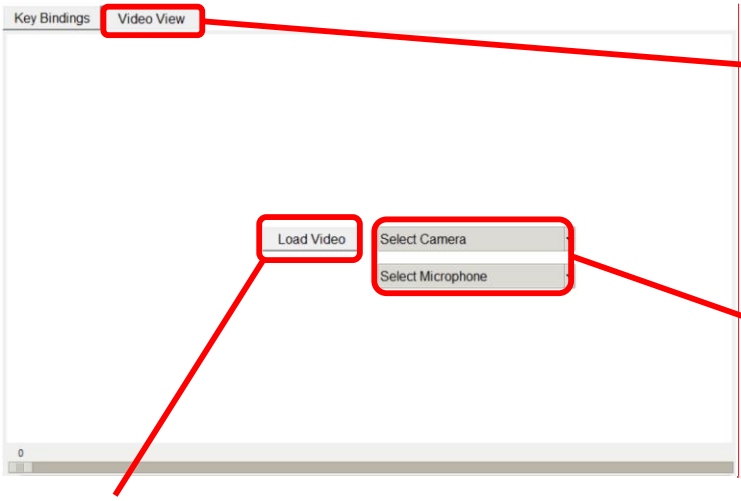
Not streaming

Connection Status

Connected

Not connected

Section 9 Video View

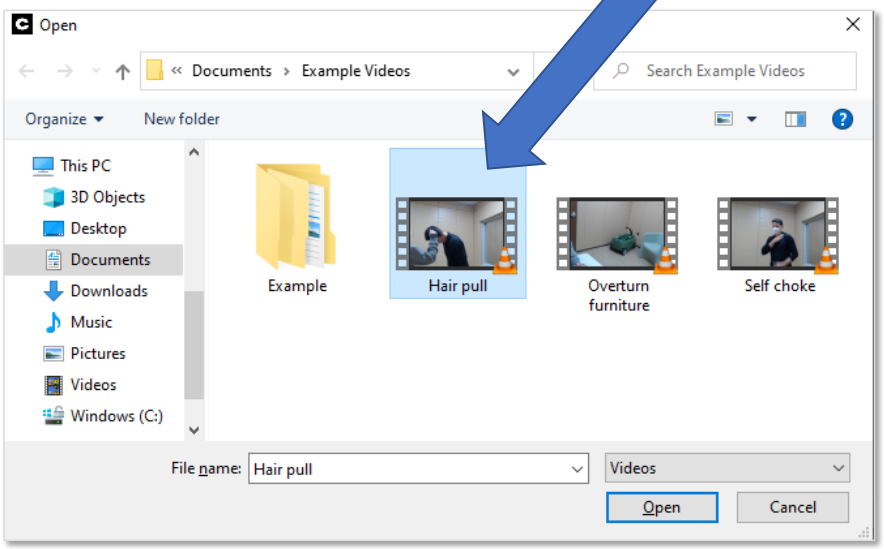


The **Video View** window shows the video recording of the session

To record from a connected **Webcam**, use the dropdown to select an input

The **Load Video** button is used to select and upload the video you want to code

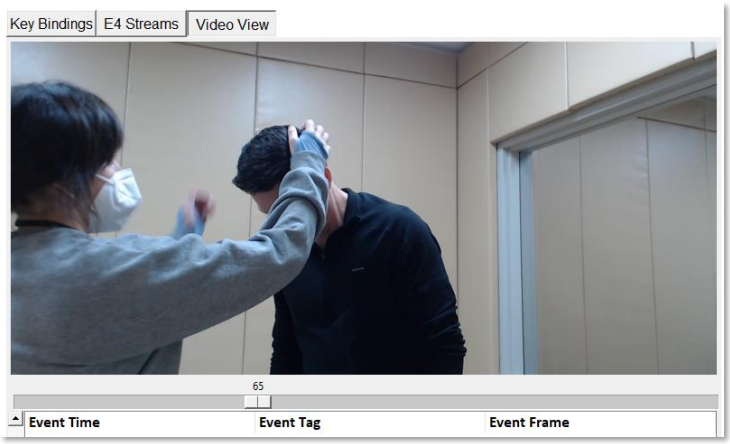
After pressing **Load Video**, locate the video file you wish to upload



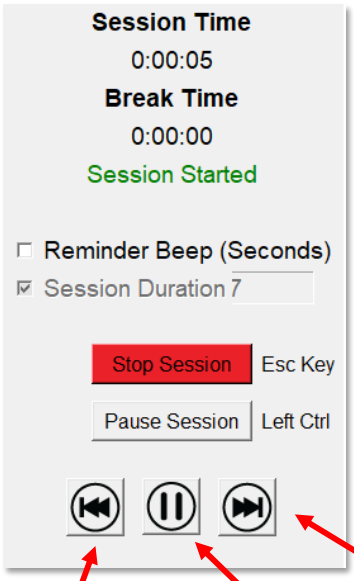
Commented [w2]: Update picture and text

Commented [w3R2]: Complete

Section 9 Video View



Selected video will upload and be viewable for coding



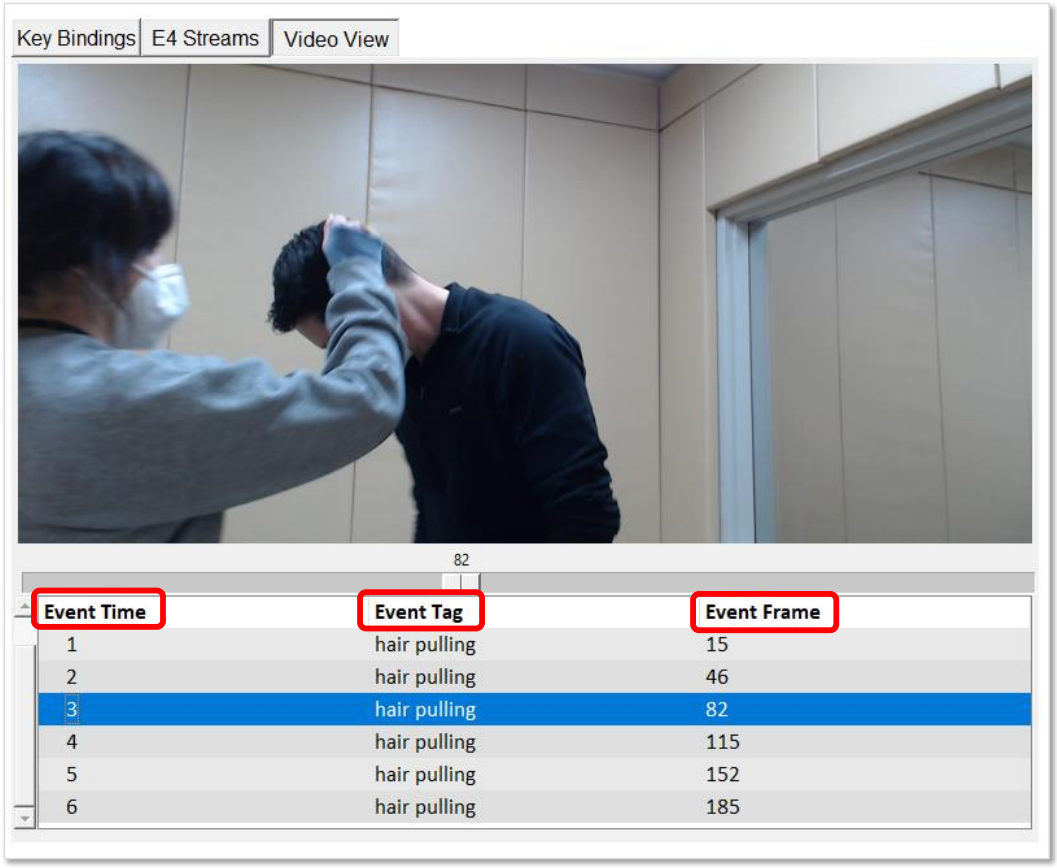
Used to go **Backward** in video by one second

Used to **Play / Pause** video

Used to go **Forward** in video by one second

Section 9 Video View

When coding an uploaded video, the **Video View** tab will look like this. The individual codes given to the video are labeled by 3 characteristics: **Event Time, Event Tag, and Event Frame.**

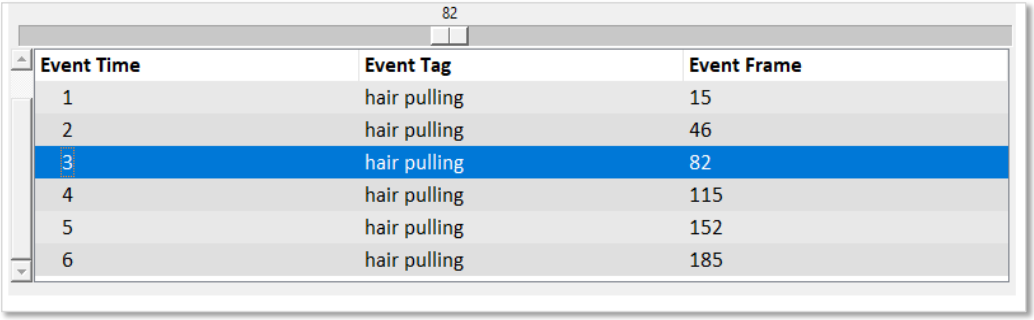


Section 9 Video View

Commented [w4]: Update with event editing

Commented [w5R4]: Complete

Codes can be viewed underneath the **Video View** Tab



Event Time	Event Tag	Event Frame
1	hair pulling	15
2	hair pulling	46
3	hair pulling	82
4	hair pulling	115
5	hair pulling	152
6	hair pulling	185

The **Event Time** column breaks the video into more manageable sections. This makes it easier to recall the general time frame in which events occurred.

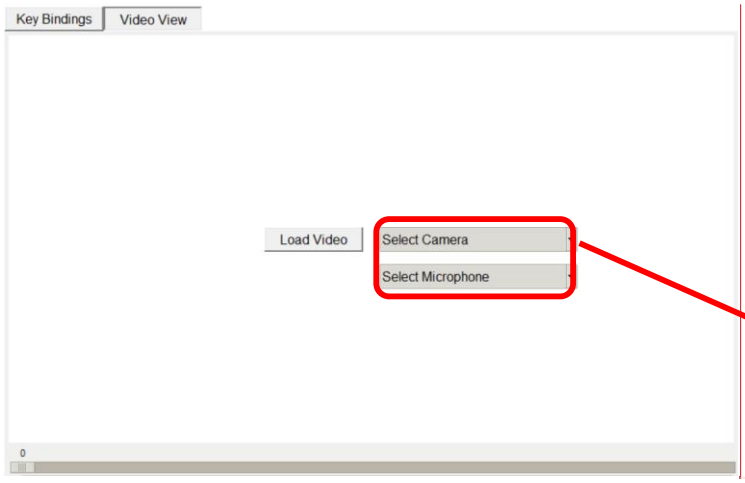
The **Event Tag** column shows the behavior assigned to the given code

The **Event Frame** tab shows the specific frame where the coded event begins

This example video has 189 total frames. The **Event Time** column breaks this down into 6 sections.

Events can be edited by double clicking an event. A popup window will open that allows the event to be changed using a dropdown.

Section 9 Video View



To turn on the **Webcam and Mic** or other connected camera, press **Select Camera** and choose the desired input and press **Select Microphone** and choose the desired input

Connected cameras can be selected for use in this tab

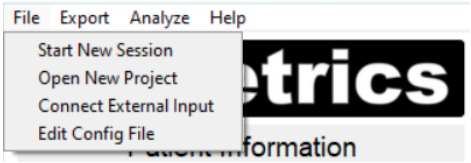
Selected cameras can be used to **view, record,** and **code** sessions **live**

The order of activation of connected **Webcams** is the order of the inputs on the camera dropdown menu

Commented [w6]: Update picture and text

Commented [w7R6]: Complete

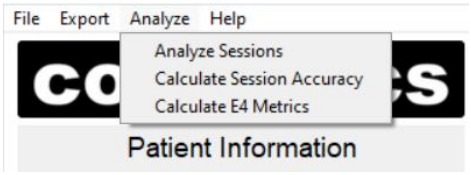
Section 10 Quick Access Menu



Start New Session – Reset the coding UI with the same settings

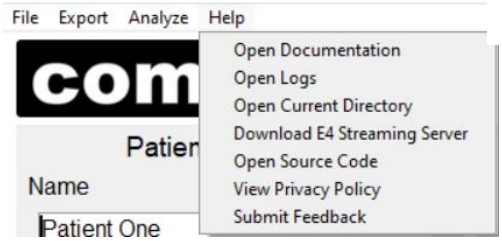
Open New Project – Close the coding UI and restart cometrics

Export CSV – Used to export all existing session data for the patient into CSV files



Analyze Sessions – Plots the session history for the patient into their KSF

Calculate Session Accuracy – Calculate the interobserver metrics between two sessions



Open Documentation – Opens this guide using default PDF viewer

Open Logs – Opens the log file directory using File Explorer

Open Current Directory – Opens the working directory for the current patient

Download E4 Streaming Server – Opens the documentation for setting up the E4 Streaming Server and automatically downloads the same

Open Source Code – Opens the default web browser to the public GitHub page for the cometrics software package

View Privacy Policy – Opens cometrics privacy policy using the default browser

Submit Feedback – Opens popup that collects feedback and sends it to the developer. This feedback will be posted as an Issue on the GitHub repository

Section 11 Keystroke File Format

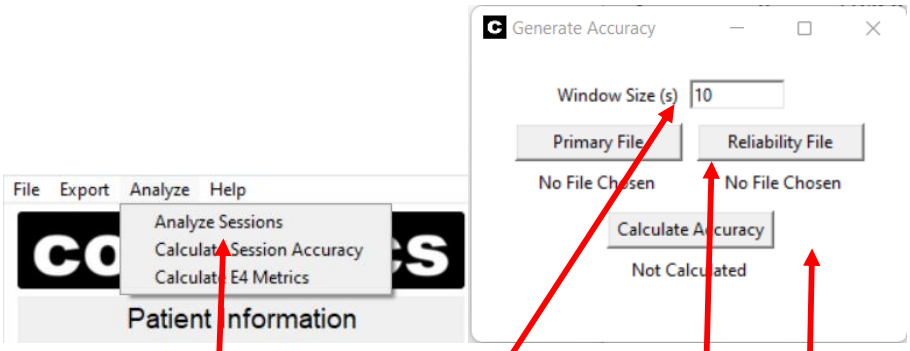
Commented [w8]: I'll add the following sections once your changes are complete

	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Assessment:_____								Session Data												
2	Client:_____			Data Coll.					Frequency						Duration						
3									q	w	e	r	t	y	a	b	c	d	e	ST	PT
4	Session	Cond.	Date	Therapist	Primary	Reliability	Notes	Sess. Dur. (mins)	Freq 1	Freq 2	Freq 3	Freq 4	Freq 5	Freq 6	Dur 1	Dur 2	Dur 3	Dur 4	Dur 5	Session Time	Pause Time

The keystroke file has a format that needs to be followed, an example of a working keystroke file can be found in the *references* folder of the root directory of the cometrics installation

The fields in the example keystroke file need to be present and when a new revision is created within the cometrics user interface, any custom fields or formatting are **not preserved**

Section 12 Interobserver Agreement Coefficients



The calculation bin size can be adjusted in units of seconds, with 10 seconds as the default

Select which session will act as the primary session

When both sessions are selected the IOA coefficients can be calculated, the output file will be highlighted in the File Explorer

Select which session will act as the reliability session

The ‘Analyze’ tab in the menu bar will allow the user to calculate the interobserver agreement (IOA) coefficients between two sessions

Pressing this button will open the window to the right

Section 12 Interobserver Agreement Coefficients

Frequency Keys Partial Interval Agreement Percentage (PIA)

For each interval, x = smaller value / larger value

If both reliability and primary have zero value, then x = 1

Partial Interval Agreement = average all x values * 100

Frequency Keys Occurrence Interval Agreement Percentage (OIA)

Given that one observer scored 1 or more for an interval, agreement if both scored at least 1

If both observers recorded zero responses, the interval is excluded

Occurrence Interval Agreement = agreements / (agreements + disagreements) * 100

Frequency Keys NonOccurrence Interval Agreement Percentage (NIA)

Given that one scored 0 for an interval, agreement if both scored 0

If both observers recorded at least one response in the interval, then the interval is excluded

NonOccurrence Interval Agreement = agreements / (agreements + disagreements) * 100

Frequency Keys Exact Agreement Percentage (EIA)

Agreement is scored if both primary and reli have same value for an interval.

Exact Agreement Percentage = total agreements / total intervals * 100

Frequency Keys Total Agreement Percentage (TIA)

Agreement = # of intervals where both scored zero or > 1

Total agreement = number of agreements / total intervals * 100

Duration Keys Partial Interval Agreement Percentage (PIA)

For each interval, x = smaller value / larger value

If both reli and primary have zero value, then x = 1

Partial Interval Agreement = the average of all x values * 100

Duration Keys Exact Interval Agreement Percentage (EIA)

For each interval the value of the primary and reli is rounded to the nearest second

Agreement is scored if both primary and reli have same value for an interval.

Exact Agreement Percentage = total agreements / total intervals * 100

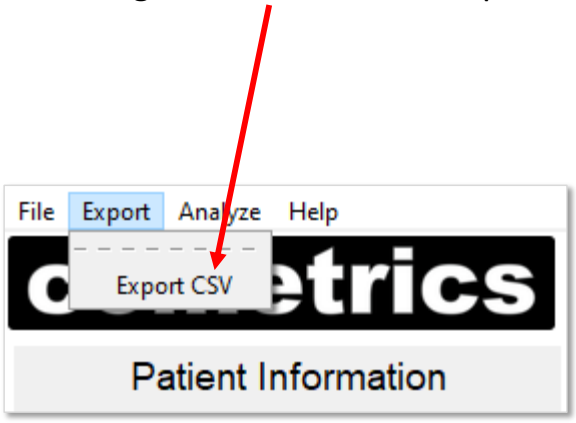
Section 13 Session Output File Format

Each session has an output file that lists all collected information during a session including the Patient Information fields, keystrokes logged with timestamps from the timer, E4 frame, and video frame, where applicable, as well as all E4 data organized into one second windows

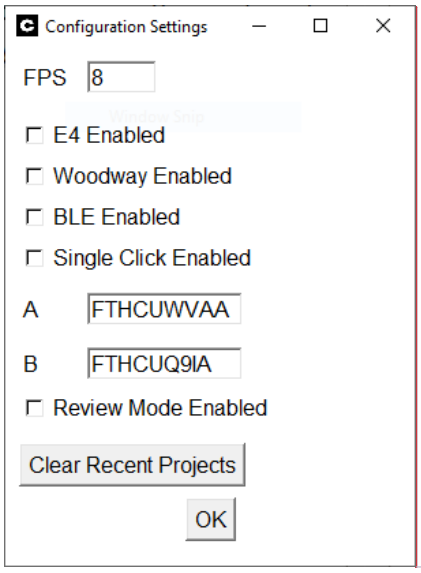
The session file is in JSON format, which is a human-readable file that is easily parsed in various programming languages

The file can be opened and read in a text file editor, such as Notepad

Additionally, sessions can be converted to comma-separated value (CSV) format using the button in the ‘Export’ tab



Section 14 Configuration Changes



Commented [CX9]: Update picture with single click enabled

Commented [w10]: Update picture

Commented [w11R10]: Complete

In the root directory of the cometrics installation is a file called *config.yml*, which defines several control variables for the software

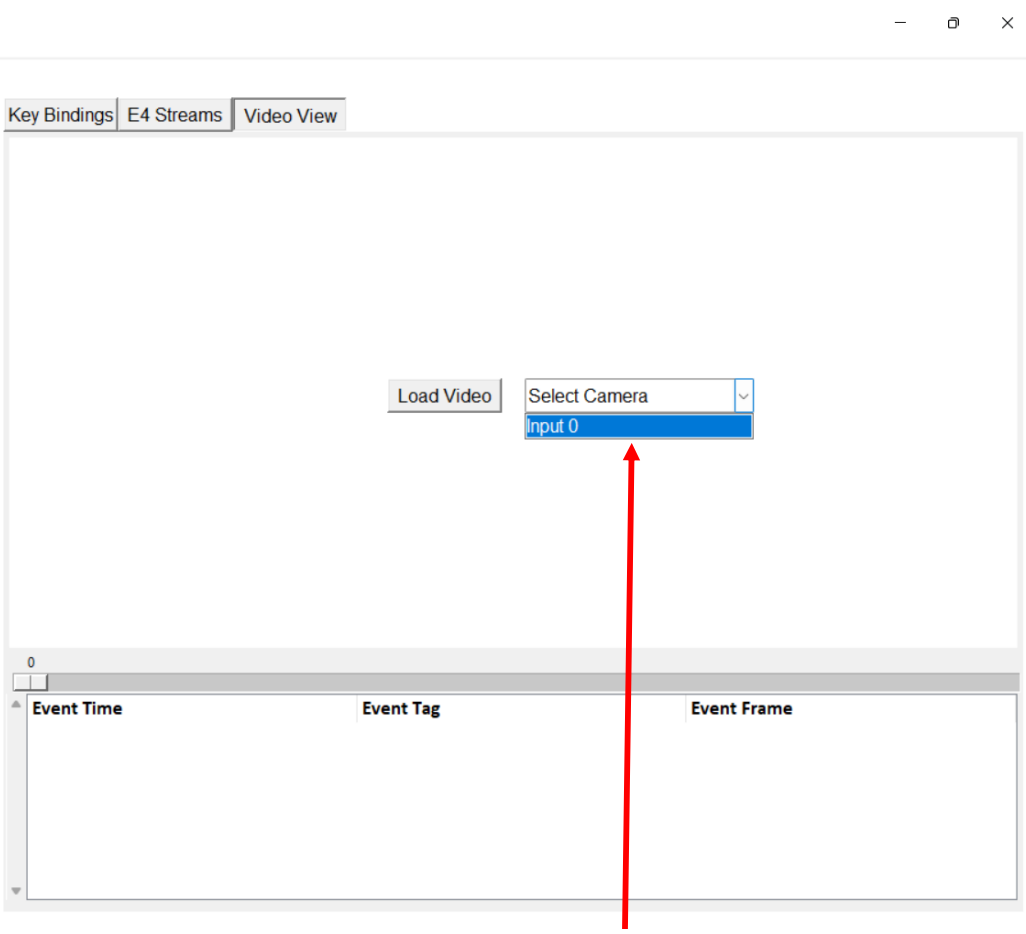
The above user interface allows the user to modify this file. The "FPS" field allows the user to change the frames per second on the webcam feed. Values up to 30 FPS have been used, but the max FPS is dependent on your camera.

The E4 checkbox enables the recording of Empatica E4 data. The Woodway checkbox enables the control of a Woodway Split Belt Treadmill. The BLE checkbox enables the control of a BLE peripheral device. The Single Click toggle between single and double click selection in Project Setup View. The Review mode checkbox enables the Review Mode tab.

The A and B fields allow the input of the serial numbers of the Woodway Split Belt Treadmill.

The "Clear Recent Projects" will delete all the projects that are saved and shown during Project Setup.

Section 15 Understanding Webcam Order



When cometrics starts up it will poll for all connected cameras, either integrated or connected via USB and the list indicated above will be populated with the cameras found

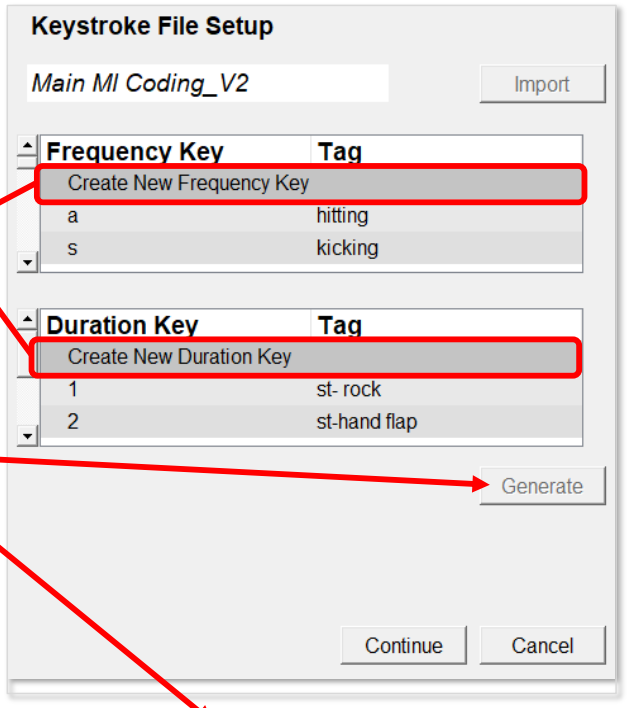
This order is the same each time given the same cameras being connected, but there is no way to differentiate between cameras

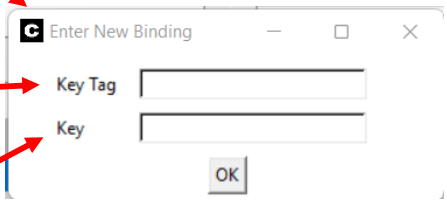
The user will have to evaluate each input to determine which camera is which input

Section 16 Modifying Keystroke Files

Pressing either of the two highlighted buttons will create a new key within the keystroke file

When a new key is created, the "Generate" button will be interactable and a popup will show





Key Tag – The tag (behavior, label, etc.) that should be associated with hitting the specified key

Key – The key press that should trigger the recording of the specified tag

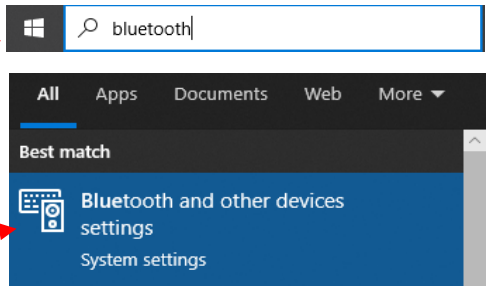
Pressing "OK" will add the key to the end of the displayed list

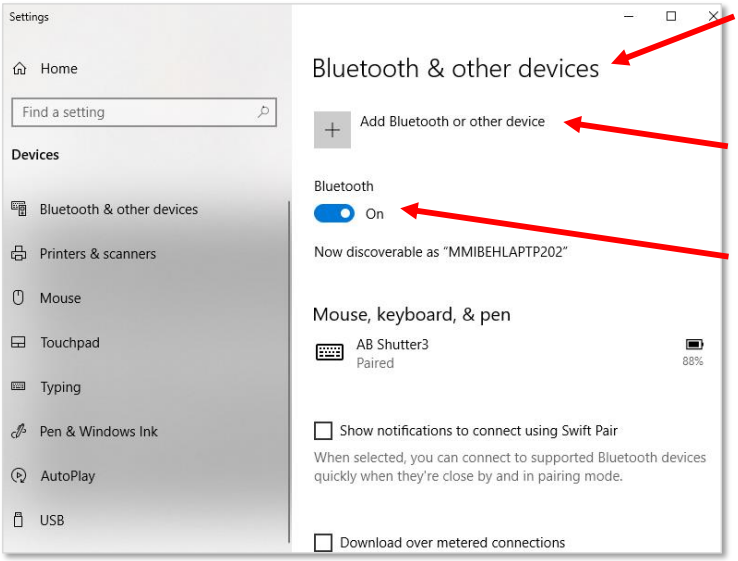
Section 17 Connecting External Input

External devices can be added via **Bluetooth** for use during coding. Connected devices (clicker, mouse, etc.) can be used as an **external button**

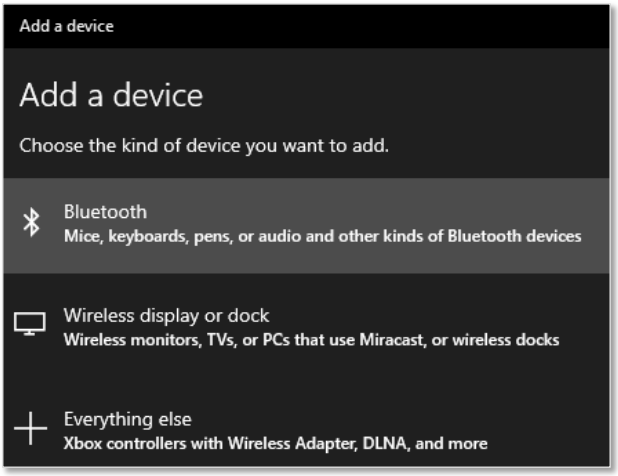
We used [this (Amazon Link)] for development, similar buttons may work but no guarantee is made.

- First, the user must **connect** the desired device to their computer **via Bluetooth**
- In the Windows search bar in the bottom left, search for "**Bluetooth and other devices settings**"
- Click to open system settings

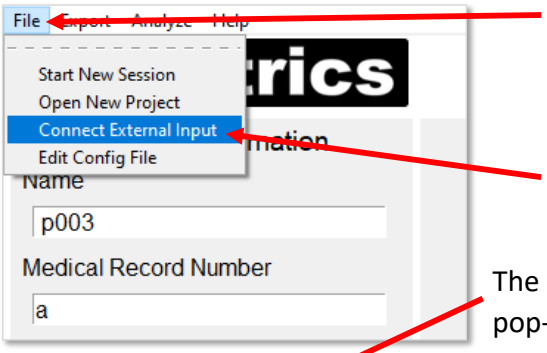




- The "Bluetooth and other devices" window will open
- Select "Add Bluetooth or other device"
- Make sure Bluetooth is turned on



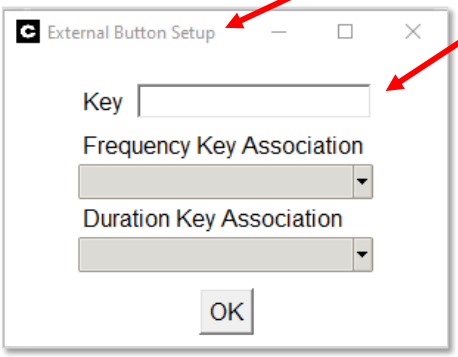
- The “Add a device” menu will open
- Select “Bluetooth” as the device type
- Find and select the desired device from the list of connectable devices
    - If the desired device is not listed, check that it is turned on / discoverable



To setup an external button in **cometrics**, select “File” in the top left-hand corner.

Select “Connect External Input”

The “External Button Setup” menu will pop-up



Use the cursor to activate the “Key” input line. Press your external device to set it as the key

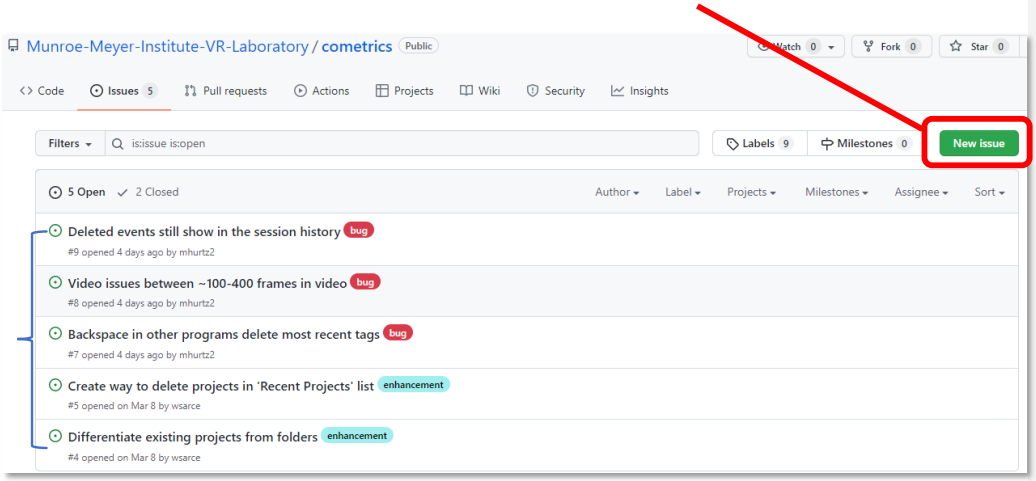
Select whether this button will be used as a Frequency key or a Duration Key

- Select the specific behavior that will be assigned to the external button

Section 18 Reporting Bugs and Other Issues (GitHub)

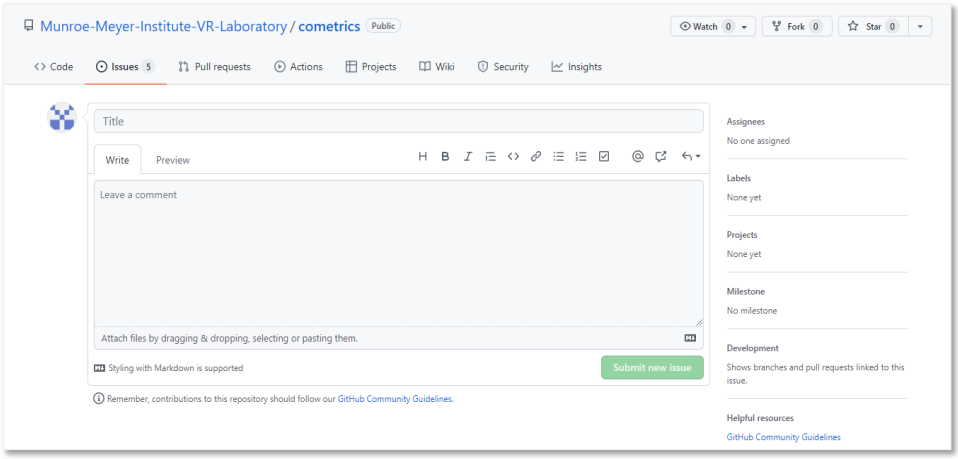
Bugs and other issues found while using the cometrics program can be reported through the Munroe Meyer Institute Virtual Reality Laboratory GitHub page. The steps for reporting a bug are as follows:

1) Create or login to a GitHub account
   https://github.com/login?return_to=https%3A%2F%2Fgithub.com%2Fjoin
2) Use the following link to access the Issues section of the cometrics' GitHub
   https://github.com/Munroe-Meyer-Institute-VR-Laboratory/cometrics/issues
3) Select the green "New Issue" button in the top right of the Issues page

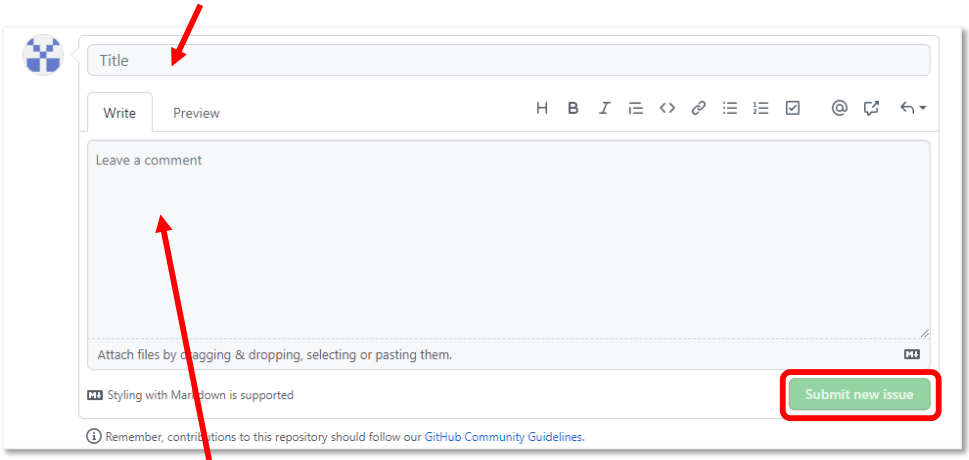


   a. The Issues page is also used to view what bugs have already been reported, preventing repeated reports of the same bug

4) The “Submit new Issue” page (pictured below) will open



5) In the “Title” section, provide a general description of the issue



6) In the “Leave a comment” section, write a detailed description of the issue (what happened, how it occurred, etc.)
7) Press the green “Submit new Issue” button in the bottom right to finalize bug report

Section 19 Woodway Split-Belt Treadmill Support

Once connected to the Woodway, the belt speed and treadmill incline can be manually changed

Pressing **Calibrate Woodway Threshold** will open the window shown on next page

Add – Create a new protocol step
Delete – Remove a selected protocol step
Load File – Select a protocol file from filesystem
Save To File – Save new revision of protocol
Connect – Connect to Woodway treadmill
Disconnect – Disconnect from Woodway treadmill
Edit – Double click any protocol step to edit

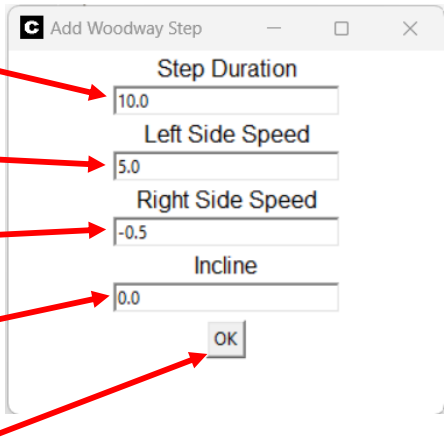
Section 19 Woodway Split-Belt Treadmill Support

Set the duration in seconds for new protocol step

Set the change in speed for the left belt for this protocol step

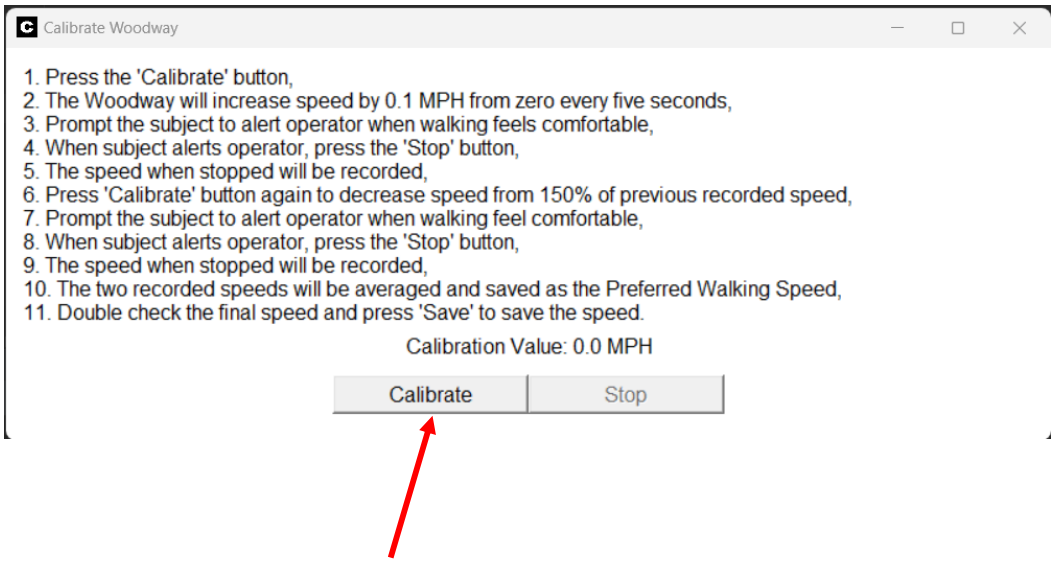
Set the change in speed for the right belt for this protocol step

Set the change in incline for the treadmill for this protocol step



Add the protocol step

Section 19 Woodway Split-Belt Treadmill Support



Press **Calibrate** to start the calibration process and follow the directions

Section 20 BLE Peripheral Support

Once connected to vibrotactors, the motor levels and frequency can be manually altered

Pressing **Calibrate Vibrotactor Threshold** will open the window shown on next page

Add – Create a new protocol step
Delete – Remove a selected protocol step
Load File – Select a protocol file from filesystem
Save To File – Save new revision of protocol
Connect – Connect to vibrotactors
Disconnect – Disconnect from vibrotactors
Edit – Double click any protocol step to edit

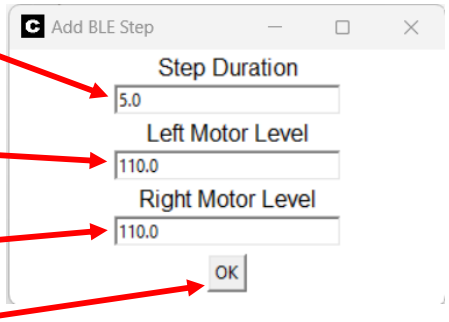
Section 20 BLE Peripheral Support

Set the duration in seconds for new protocol step

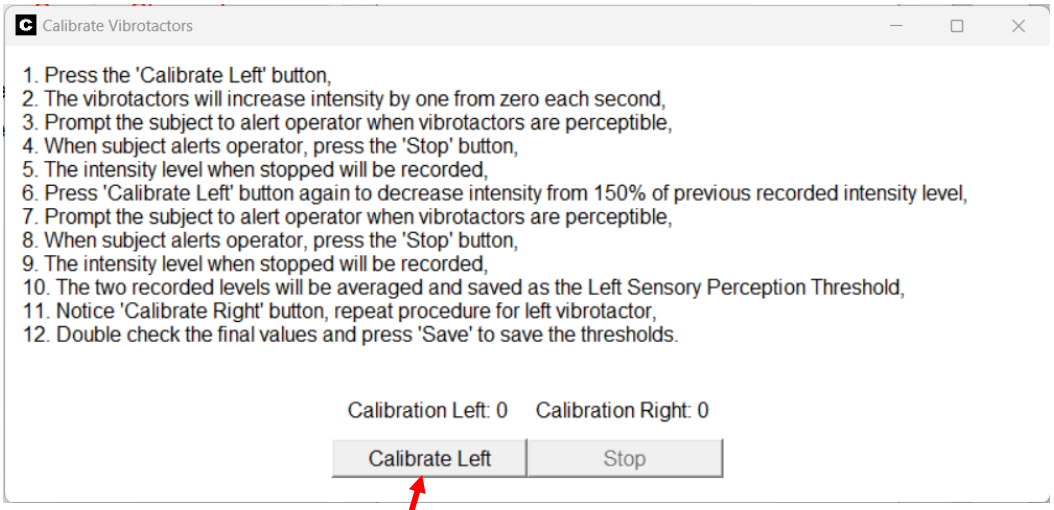
Set the motor vibration level for the left vibrotactor array as a percentage of the threshold

Set the motor vibration level for the right vibrotactor array as a percentage of the threshold

Add the protocol step



Section 20 BLE Peripheral Support



Press **Calibrate Left** to start the calibration process and follow the directions

Section 21 Review Mode

Review Mode allows for recorded sessions to be expert validated.

The reviewer will put their name into the textbox.

The data type then will be selected and, if sessions exist, each session is selectable.

The status of the session (whether it's been reviewed and by whom) is shown above the session number.

The arrows allow switching between sessions.

When the correct session is selected, press the 'Load Session' button.

All the events in that session are now selectable and load in automatically.

The keystroke associated with each event can be changed, though only one keystroke is allowed per session.

Pressing 'Play Clip' will show the video segment that has been selected as representing the selected keystroke.

The two textboxes below are the 'To' and 'Frame' entries and display the corresponding start and end frames of the video clip.

When an event is accepted or rejected, the changes made will be saved and the next event will be loaded.

Once all events have been either accepted or rejected, the session can be approved, which will mark is as 'Reviewed' and save the reviewer's name with the session.

If a session is approved, the name of the reviewer will be shown along with a checkmark indicating approval.

Section 22 Loading Previous Sessions

Previous sessions can be loaded by changing the session number in the Patient Information window. The session will be automatically loaded and the video file path will be assigned to the Video View panel so that when the Load Video button is clicked then the session video will load.

Edits to the events in the Video View event viewer will automatically save to the source session file so the session doesn't need to be started to make simple changes.

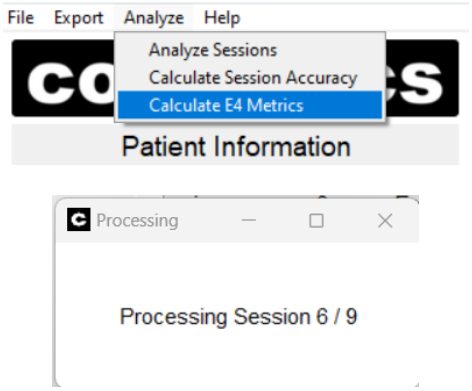
Changing the session number will either load an existing session or, if a session does not exist, will clear the previous loaded session to allow standard operation.

Section 23 Calculating E4 Metrics

A utility has been built in to the 'Analyze' menu tab to calculate statistical metrics from your collected Empatica E4 data. Both the photoplethysmography (PPG) and electrodermal activity (EDA) are processed for analysis purposes. The metrics are calculated on a 20 second interval and the corresponding frequency and duration measures are binned.

The EDA metrics are the total number of peaks and the average amplitude of the signal during the 20 second interval.

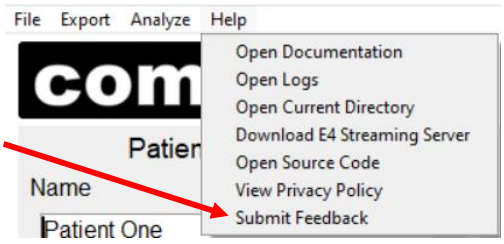
The PPG metrics are the heart beats per minute and heart rate variability metrics.



Once completed, the output directory will be opened. The files are saved as CSV files in the Export directory of your current patient.

Section 24 Sending Feedback

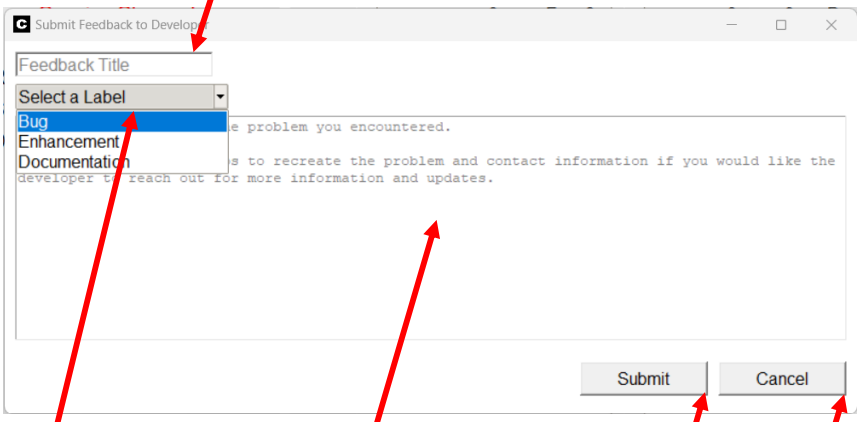
In cometrics v1.3.0, a new user interface is available that allows an anonymous user to submit feedback.



To open this user interface, press the 'Submit Feedback' button under the 'Help' menu bar.

To understand this process and what data is sent, please read the privacy policy!

Feedback messages need a title, make it descriptive and simple.



Select a label for this feedback

Bug – A problem or error encountered in the software

Enhancement – A suggestion to improve the software

Documentation – When a function of cometrics is not well-defined

Enter a description for your feedback, the more detail added the easier it will be to address!

When all fields are complete, press 'Submit,' and it is sent to the developer on GitHub

Press 'Cancel' to close the window and lose any changes made to it