

Virtual Reality Laboratory in the Munroe Meyer Institute

# cometrics

User Guide

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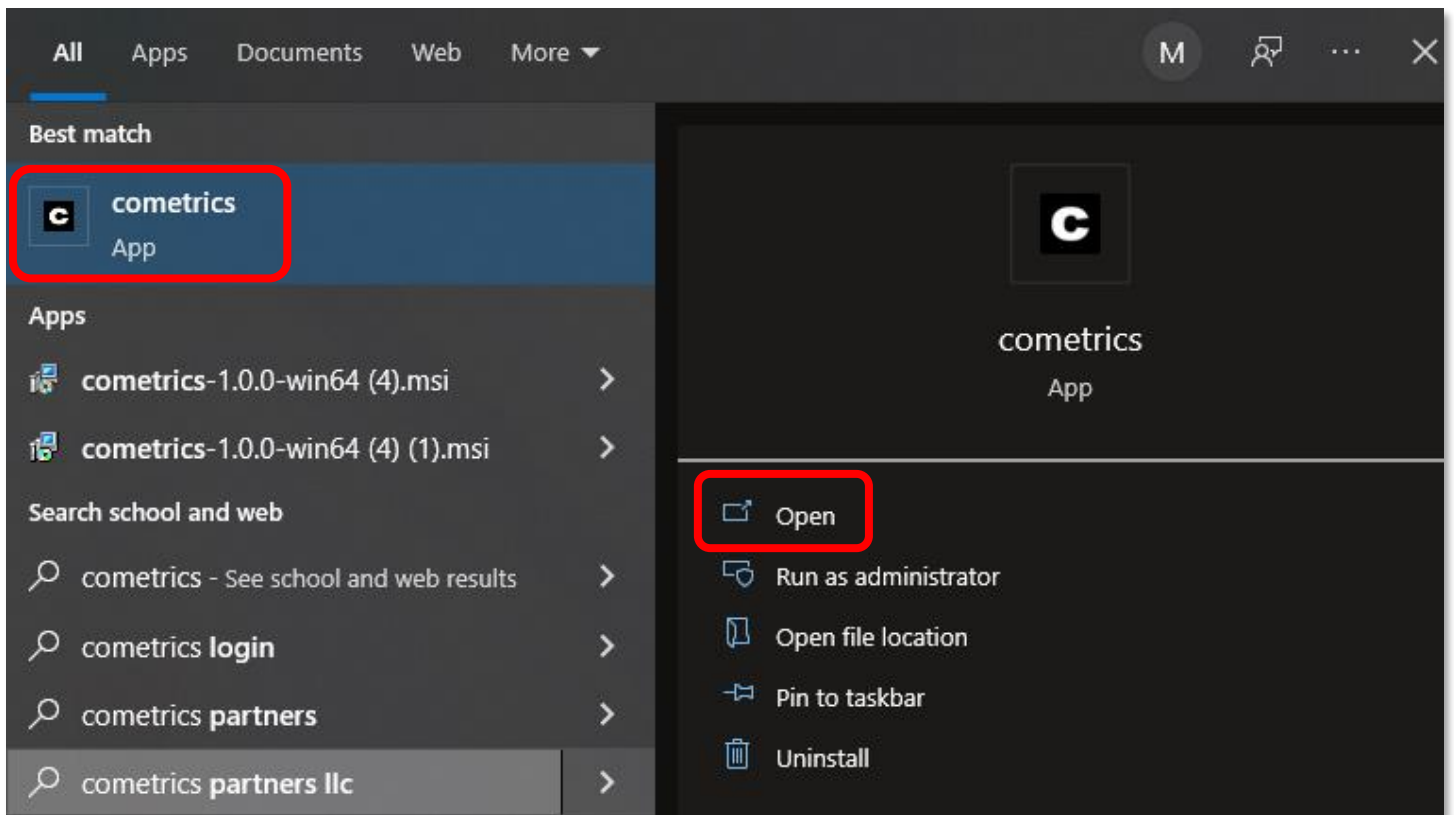
## Section 1 Open Program



- Locate the **cometrics** icon on desktop

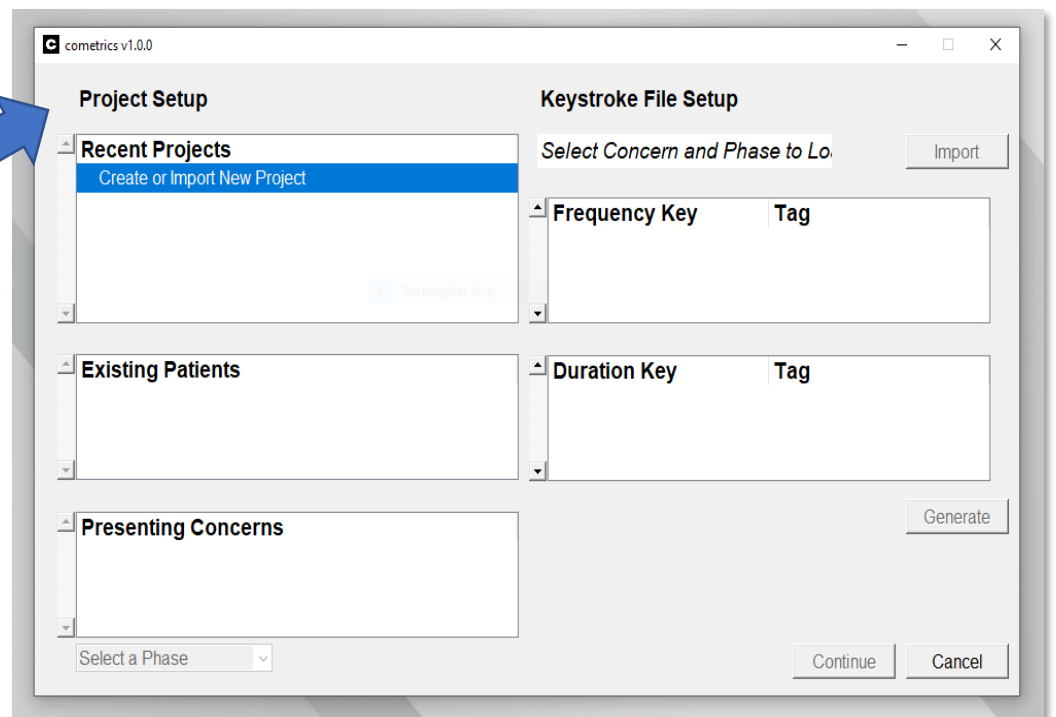
OR

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



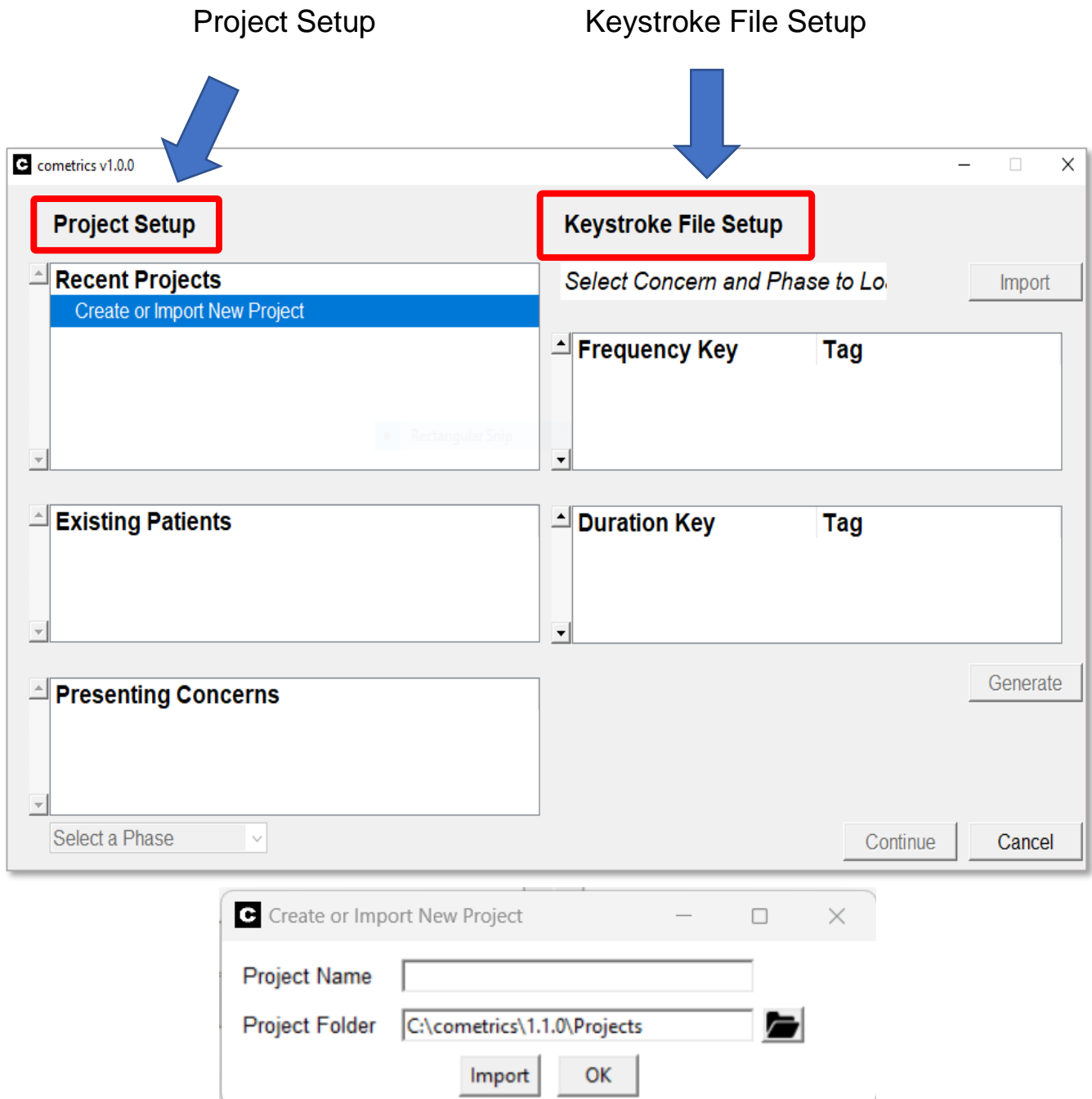
## Section 1 Open Program (cont.)

- **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

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**Project Setup**

**Recent Projects**

Create or Import New Project

Rectangular Snip

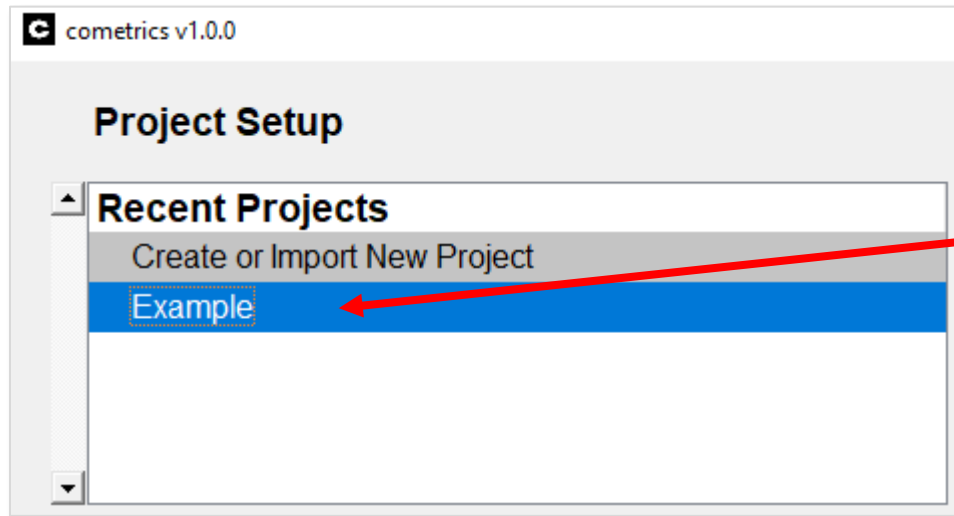
**Existing Patients**

**Presenting Concerns**

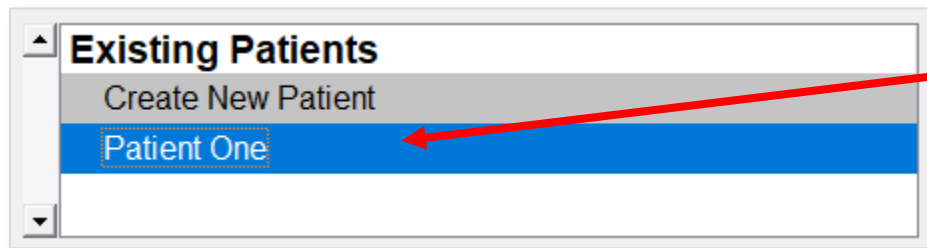
Select a Phase

- **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

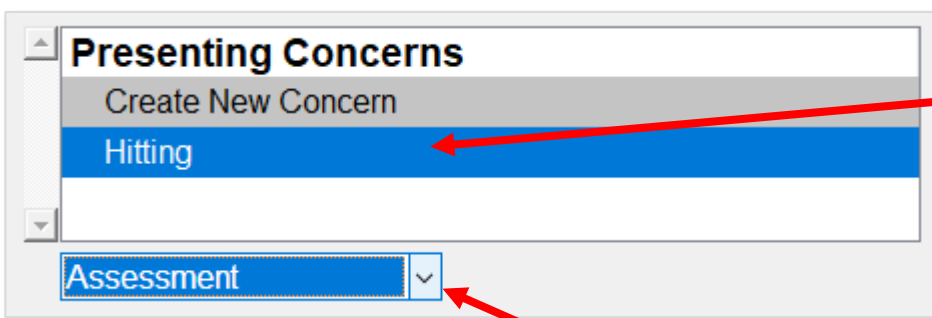
## Section 3 Project Setup (cont.)



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



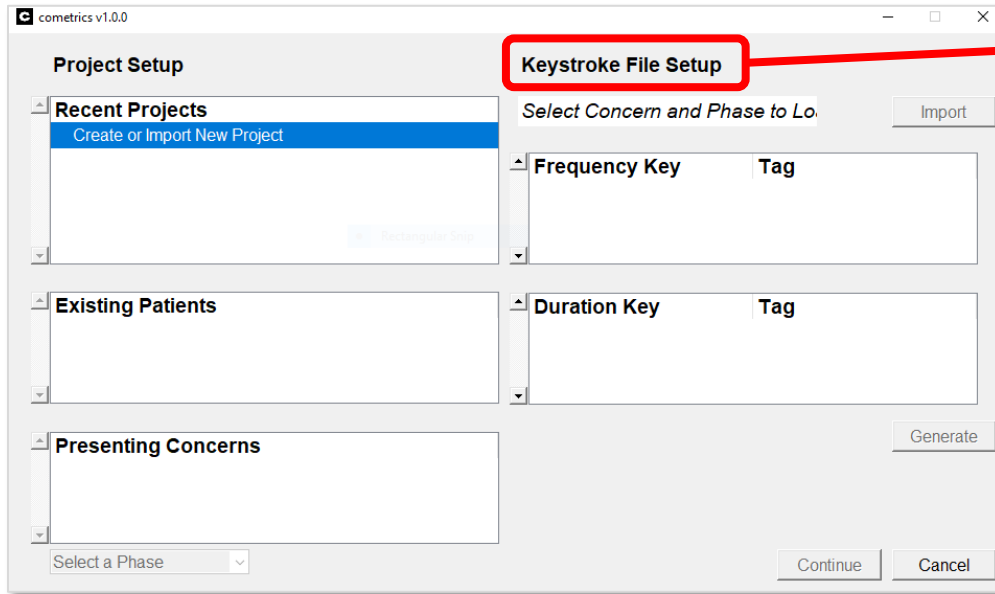
- 2) Create or select the patient being assessed



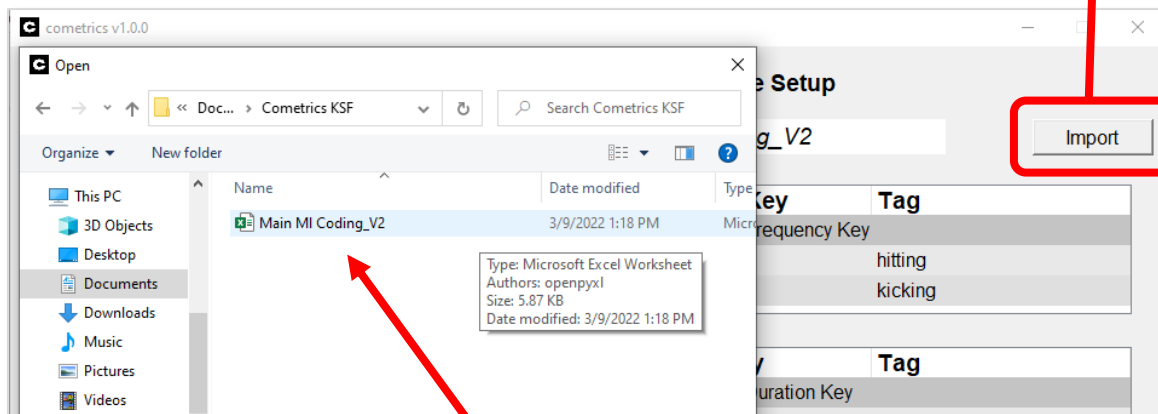
- 3) Create and add the presenting concerns in the session

- 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



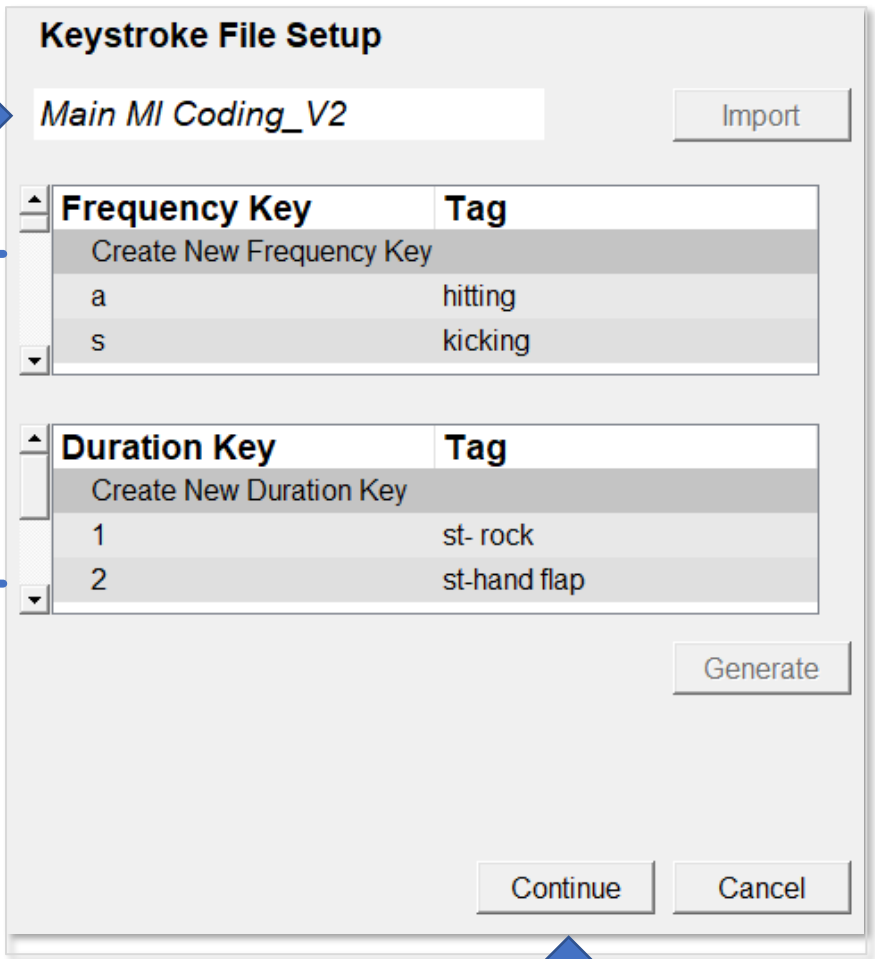
- If a file is not already uploaded, press **Import** to find and select the Excel file you wish to use for coding



## Section 4

### Keystroke File Setup (cont.)

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



The dialog box titled "Keystroke File Setup" contains the following elements:

- A text field at the top containing "Main MI Coding\_V2". A blue arrow points to this field from the text "Name of the selected Excel file".
- An "Import" button to the right of the text field.
- A section titled "Frequency Key" with a "Tag" column. It includes a "Create New Frequency Key" button and a list of keys: "a" (hitting) and "s" (kicking). A blue bracket points to this section from the text "Preview of the coding keys in the Excel file".
- A section titled "Duration Key" with a "Tag" column. It includes a "Create New Duration Key" button and a list of keys: "1" (st-rock) and "2" (st-hand flap).
- A "Generate" button at the bottom right of the main area.
- "Continue" and "Cancel" buttons at the bottom right. A blue arrow points to the "Continue" button from the text "Select Continue in the bottom right to begin coding".

- 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 all sections of **Patient Information** are complete (error messages will occur until the spaces are filled)

The screenshot shows a form titled "Patient Information" with the following fields and annotations:

- Name**: Input field containing "Example Patient". Annotation: "Patient name".
- Medical Record Number**: Input field. Annotation: "Unique identifier for patient".
- Session Location**: Input field. Annotation: "Where the session is happening".
- Assessment Name**: Input field. Annotation: "The name of the assessment".
- Condition Name**: Dropdown menu. Annotation: "Induced stimulus that you are recording measures for".
- Primary Therapist**: Input field. Annotation: "Name of primary therapist".
- Case Manager**: Input field. Annotation: "Name of case manager".
- Session Therapist**: Input field. Annotation: "Name of session therapist".

At the bottom of the form, there are navigation controls:

- A left arrow button.
- A tab indicator showing "1/3".
- A right arrow button.

- There are 3 **Patient Information** tabs

- Use the arrows to navigate the **Patient Information** tabs

## Section 5 Patient Information (Page 2)

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**Patient Information**

Data Recorder  
Your Name |

Session Number  
1

Primary or Reliability Session  
☒ Primary ☐ Reliability

Session Date: March 07, 2022  
Session Start Time: 16:19:24

← 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

← 2/3 →

## Section 5 Patient Information (Page 3)

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Patient Information	
Char	Tag
a	hitting
s	kicking
d	pushing
f	grab_scratch
g	head butting
j	hair pulling
h	biting
k	choking
l	sib-head bang
q	sib-head hit
w	sib-self-hit
e	sib-biting
r	sib-eye poke
t	sib-body slam
y	sib-hair pull
u	sib-choking
i	sib-pinch_scratch
o	throwing object

Navigation controls: Left arrow, 3/3, Right arrow

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

The screenshot shows a control panel for session timing. It includes two time displays: 'Session Time' at 0:00:05 and 'Break Time' at 0:00:00. Below these is a status indicator 'Session Started' in green. There are two checkboxes: 'Reminder Beep (Seconds)' which is unchecked, and 'Session Duration 7' which is checked. At the bottom are three buttons: 'Stop Session' (red), 'Pause Session' (grey), and three circular icons (Backward, Play/Pause, Forward). Blue arrows point from text descriptions to the time displays and status indicator. Red arrows point from text descriptions to the three circular icons.

**Session Time** 0:00:05 ← Records the amount of time spent coding

**Break Time** 0:00:00 ← Records the amount of time spent paused

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

☐ Reminder Beep (Seconds)

☒ Session Duration 7

**Stop Session** Esc Key ← Start / Stop the session

**Pause Session** Left Ctrl ← Pause / Resume the session

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

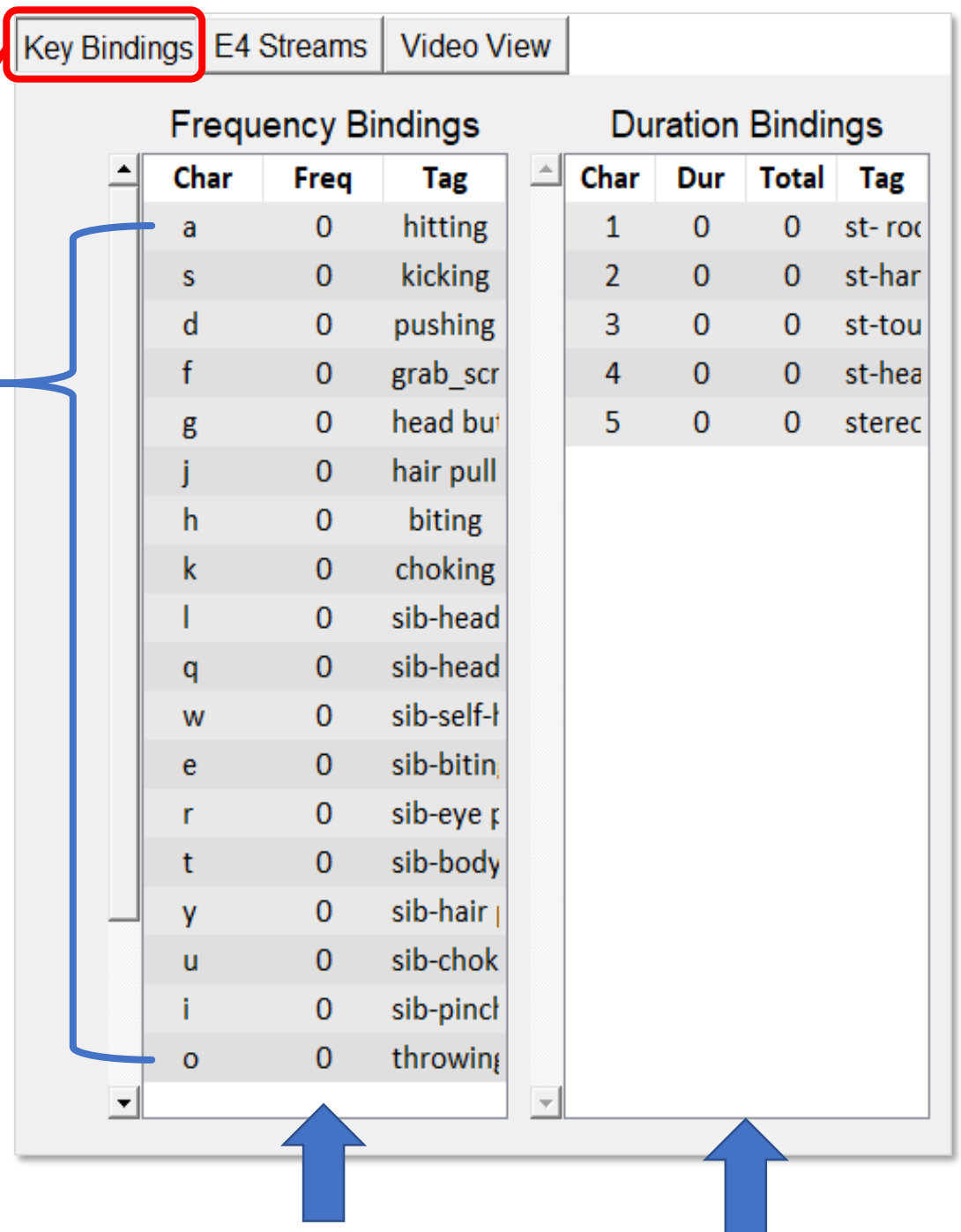
• Used to **Play / Pause** video in video tab

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

## Section 7

## Key Bindings

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

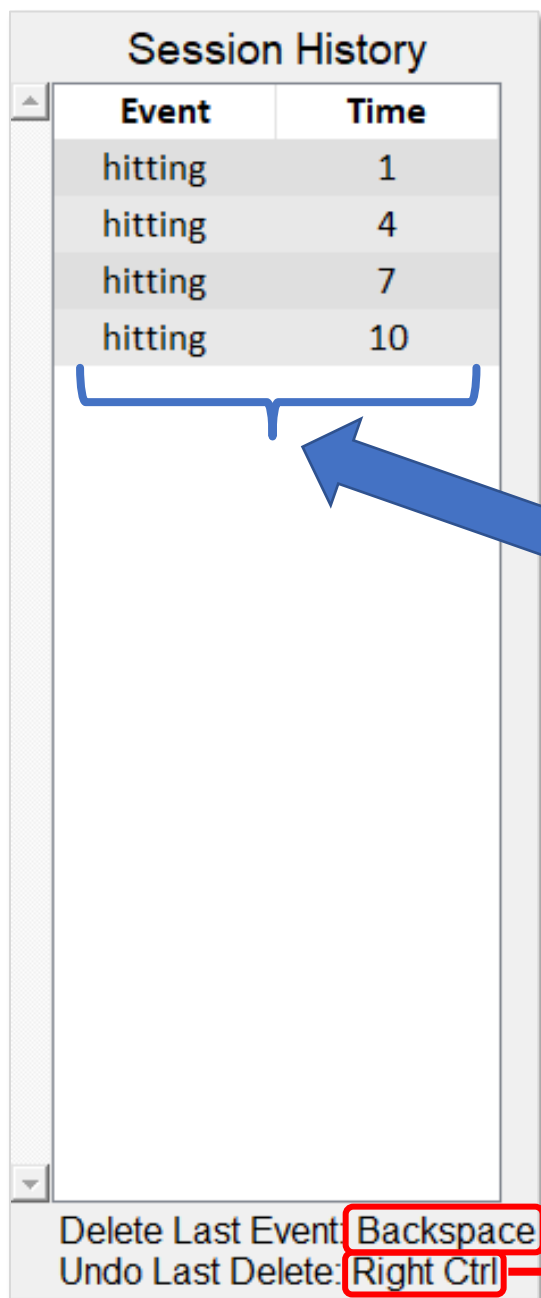


Frequency Bindings			Duration Bindings			
Char	Freq	Tag	Char	Dur	Total	Tag
a	0	hitting	1	0	0	st-roc
s	0	kicking	2	0	0	st-har
d	0	pushing	3	0	0	st-tou
f	0	grab_scr	4	0	0	st-hea
g	0	head bui	5	0	0	sterec
j	0	hair pull				
h	0	biting				
k	0	choking				
l	0	sib-head				
q	0	sib-head				
w	0	sib-self-l				
e	0	sib-bitin				
r	0	sib-eye p				
t	0	sib-body				
y	0	sib-hair				
u	0	sib-chok				
i	0	sib-pincl				
o	0	throwing				

- 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

## Section 7

## Key Bindings (cont.)



Event	Time
hitting	1
hitting	4
hitting	7
hitting	10

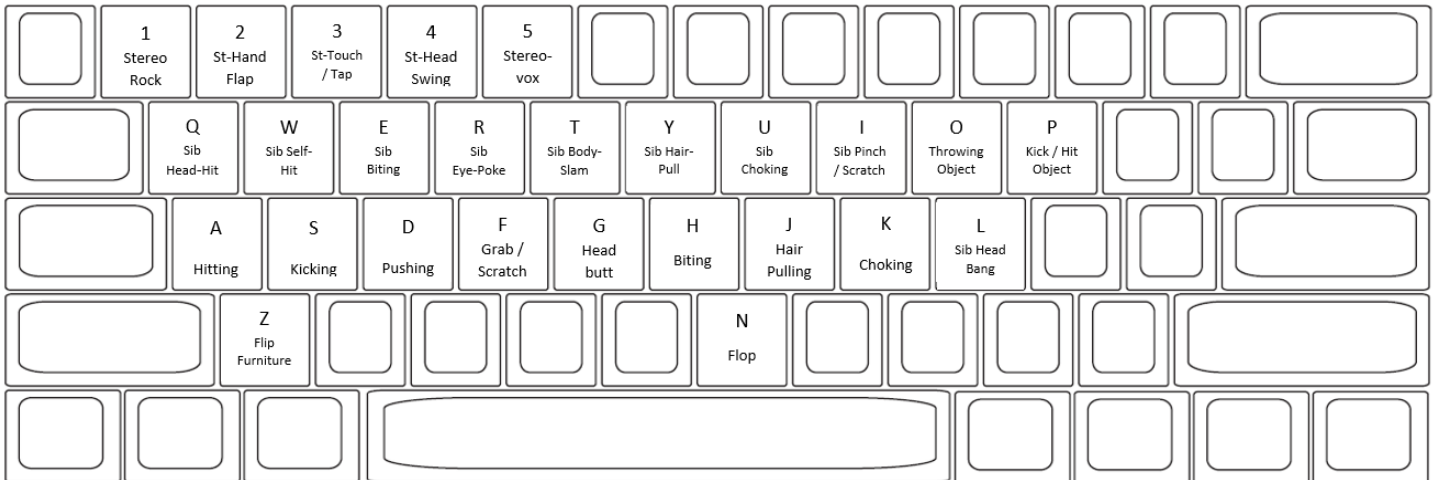
Delete Last Event: Backspace

Undo Last Delete: Right Ctrl

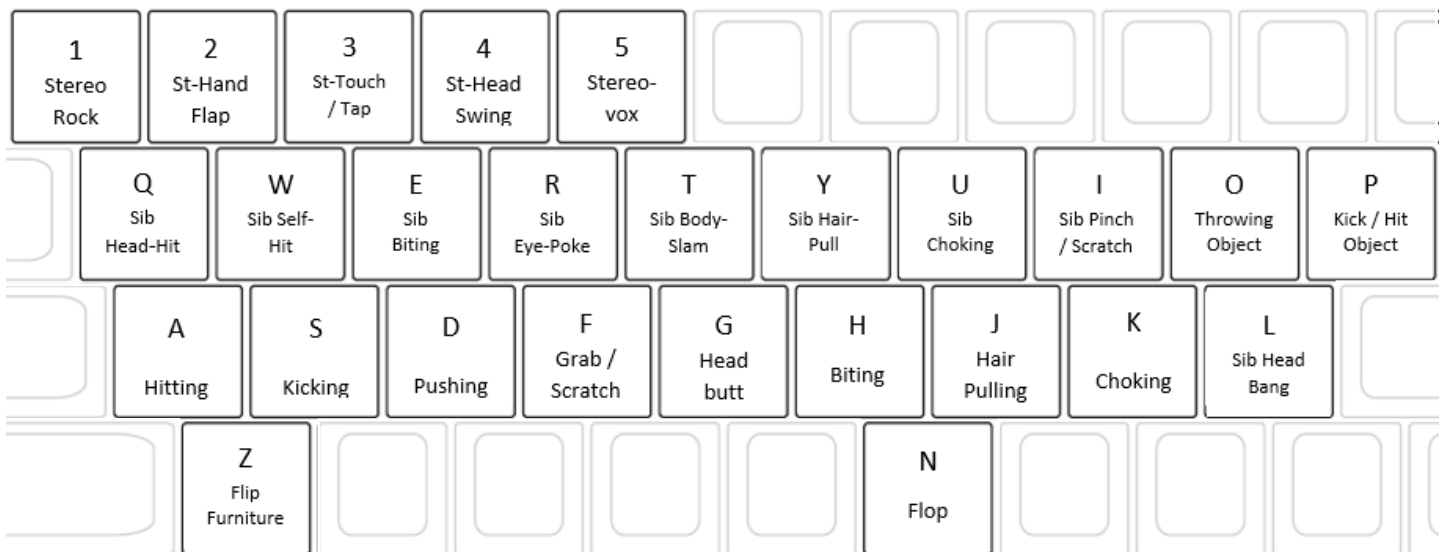
- The **Session History** tab gives a basic view of what codes have been used and the time (in seconds) at which they occurred
- The **Event** and **Time** columns show what behaviors have been coded during the session and at what time they occurred, respectively
- Press **Backspace** to delete the last coded event
- Press the **Rightmost Control** key to undo the last deleted event

## Section 7 Key Bindings (Keyboard)

### Keyboard Codes



### Keyboard Close Up



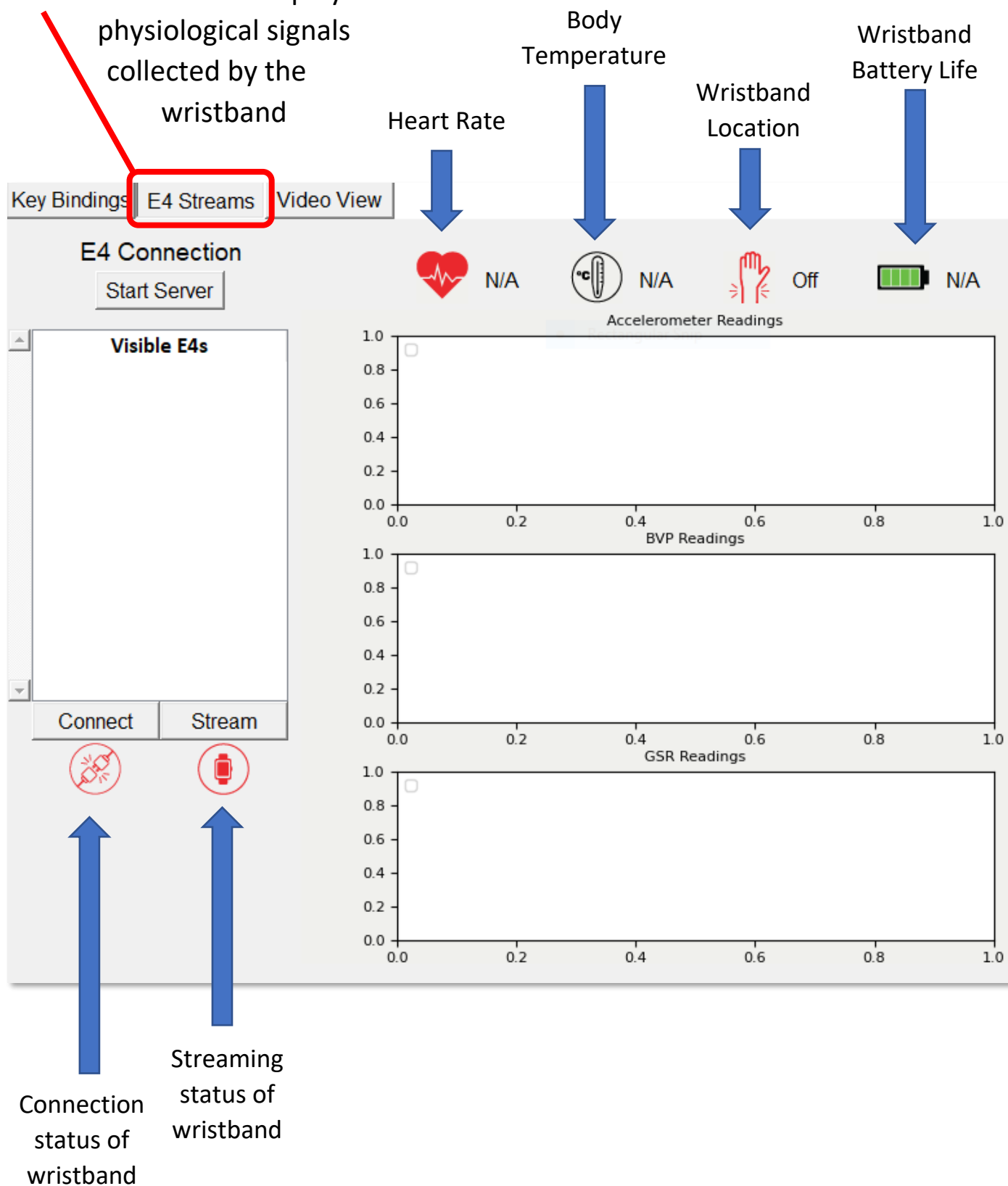
**\*\*For exact descriptions of each behavior,  
see **Operational Definitions** document**

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



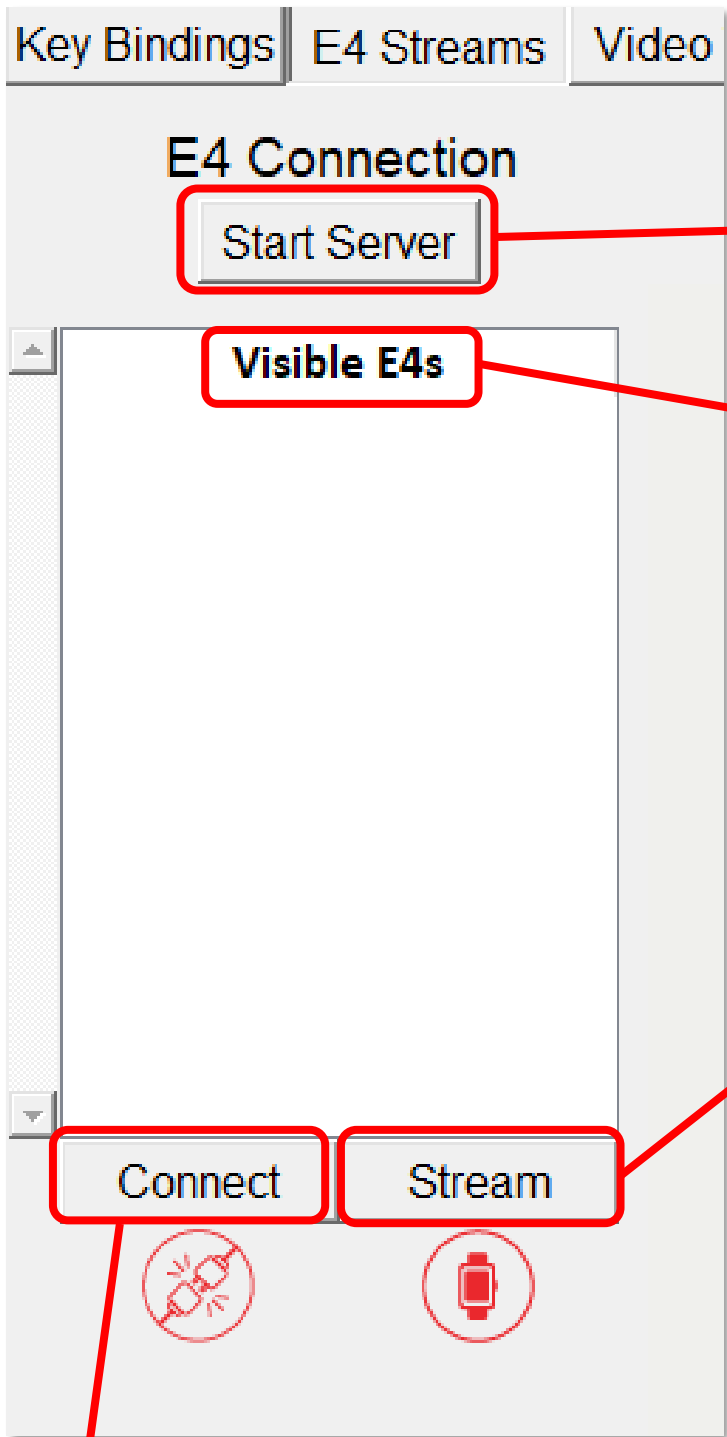
## Section 8 E4 Streams

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



## Section 8

## E4 Streams (cont.)



The screenshot shows a software interface with three tabs at the top: 'Key Bindings', 'E4 Streams', and 'Video'. The 'E4 Streams' tab is active. Below the tabs, the title 'E4 Connection' is displayed. Under this title, there is a 'Start Server' button, a 'Visible E4s' tab, and two buttons at the bottom: 'Connect' and 'Stream'. Red boxes highlight the 'Start Server' button, the 'Visible E4s' tab, and both the 'Connect' and 'Stream' buttons. Red lines connect these highlighted elements to explanatory text on the right. Below the 'Connect' button, there is a red icon of a wristwatch with a signal wave. Below the 'Stream' button, there is a red icon of a wristband.

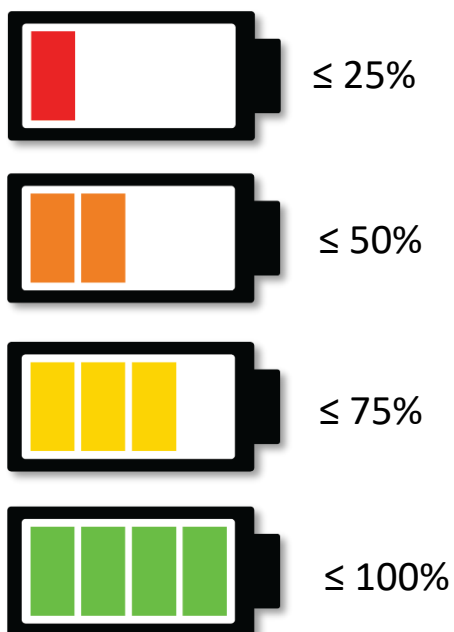
- Press **Start Server** to begin utilizing the E4 wristband
- The **Visible E4s** tab shows the available wristbands that can be used to stream data
- Select **Stream** to start streaming the data from the wristband to the cometrics program
- Select **Connect** to connect the wristwatch to the cometrics program

## Section 8

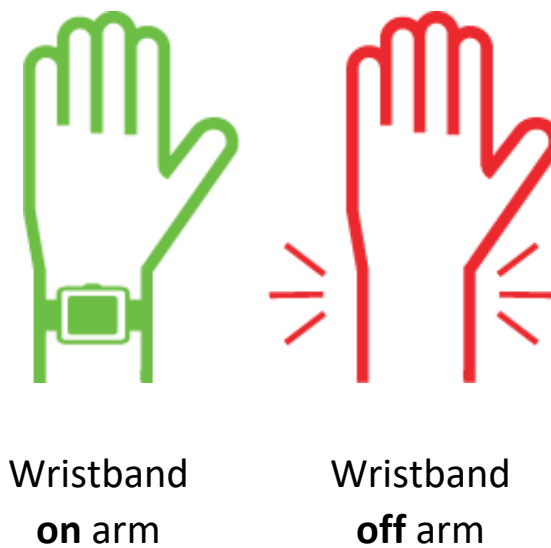
## E4 Streams (Icons)

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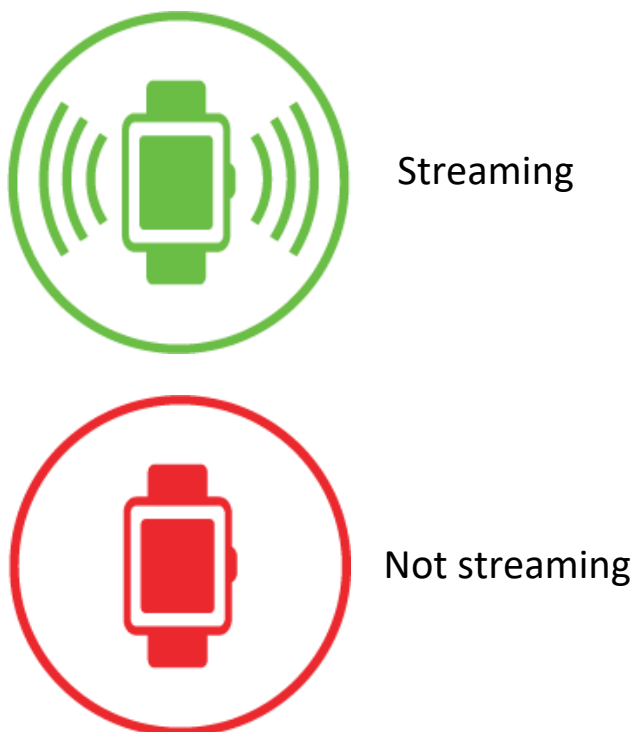
### Battery Life



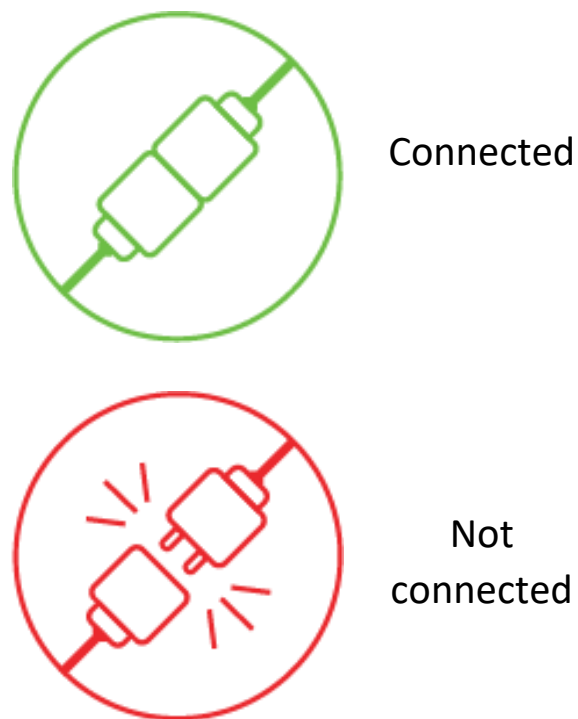
### Wristband Location



### Streaming Status

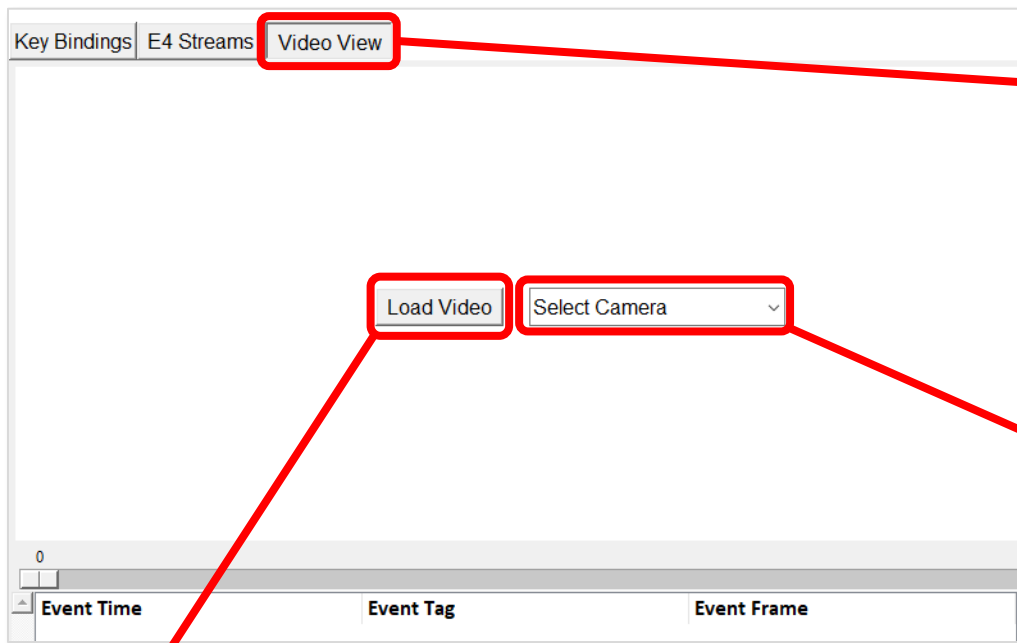


### Connection Status



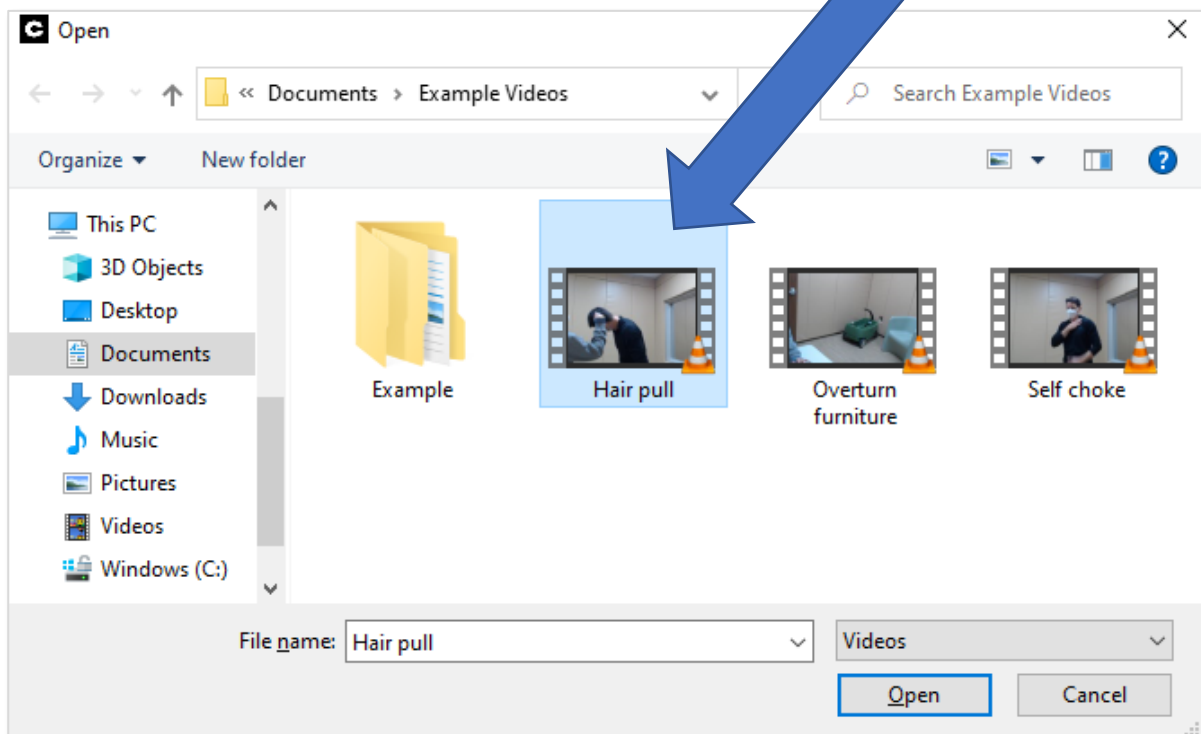
## Section 9

## Video View

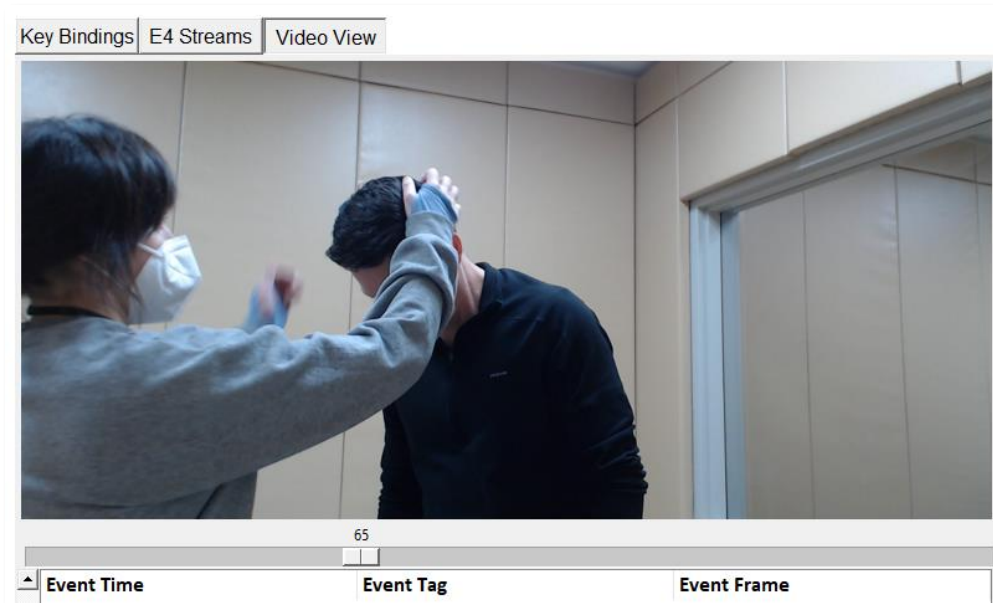


- The **Video View** window shows the video recording of the session
- To record from a connected **Webcam**, use the dropdown to select an input
- The **Load Video** button is used to select and upload the video you want to code

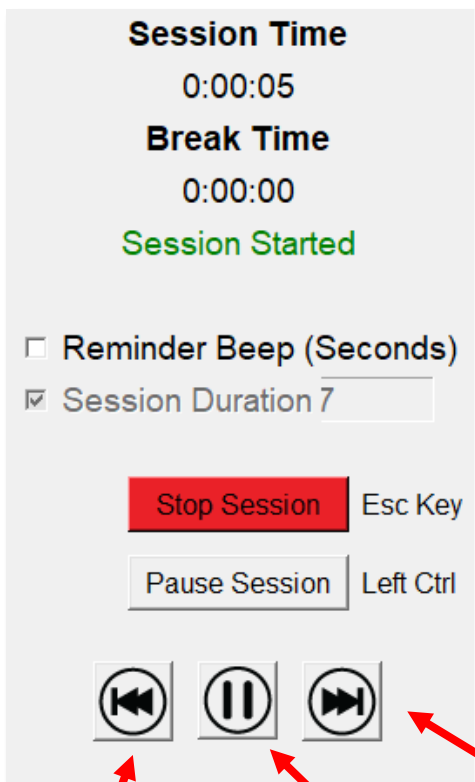
- After pressing **Load Video**, locate the video file you wish to upload



## Section 9 Video View (cont.)



- 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 (cont.)

- 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**.

Key Bindings | E4 Streams | Video View

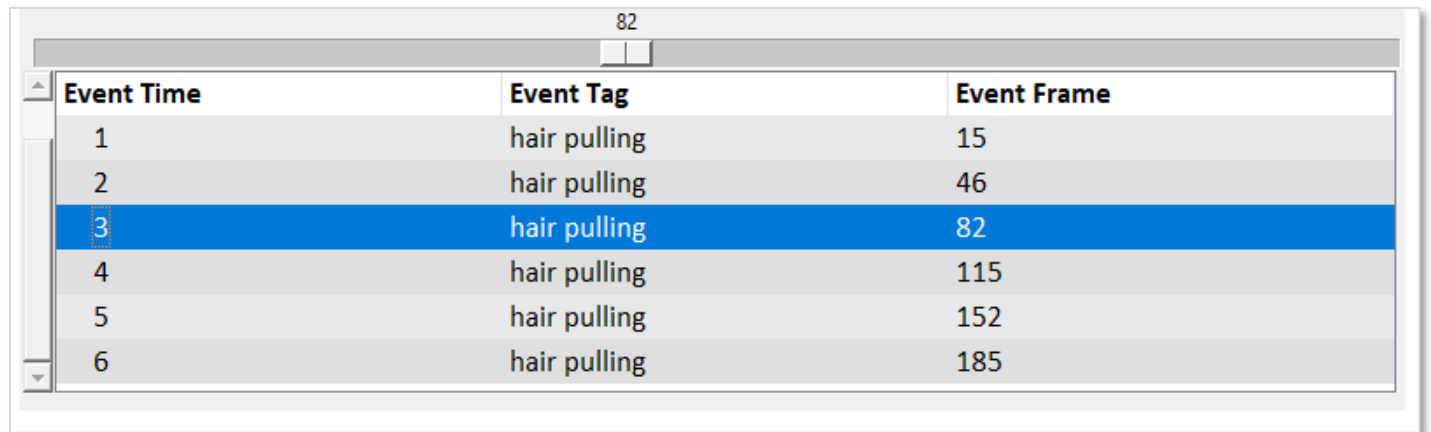


Event Time	Event Tag	Event Frame
1	hair pulling	15
2	hair pulling	46
3	hair pulling	82
4	hair pulling	115
5	hair pulling	152
6	hair pulling	185

## Section 9 Video View (cont.)

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

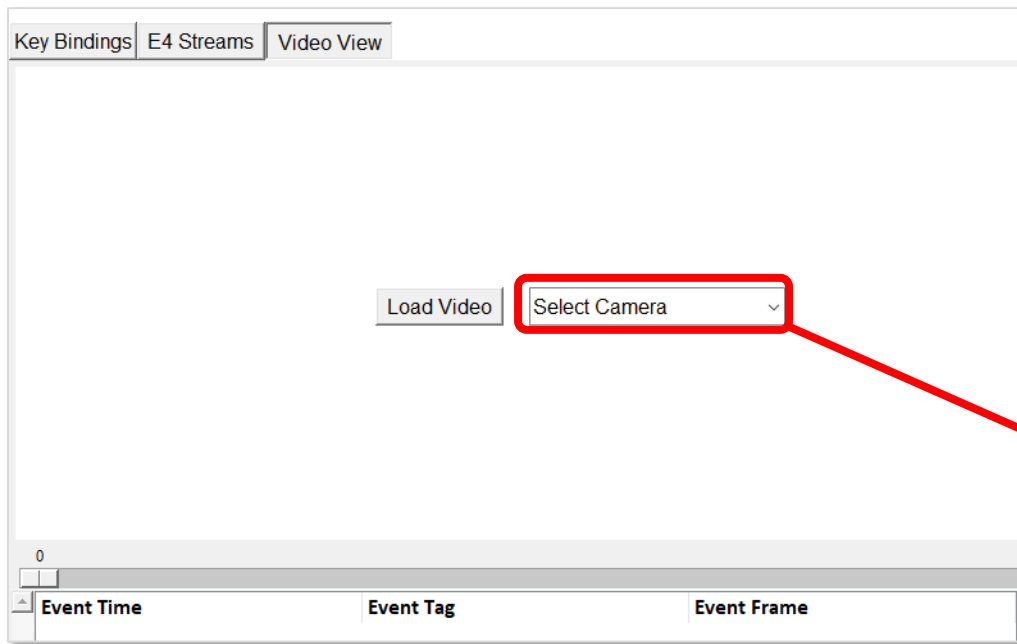


Event Time	Event Tag	Event Frame
1	hair pulling	15
2	hair pulling	46
3	hair pulling	82
4	hair pulling	115
5	hair pulling	152
6	hair pulling	185

- 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.

## Section 9

## Video View (Select Camera)

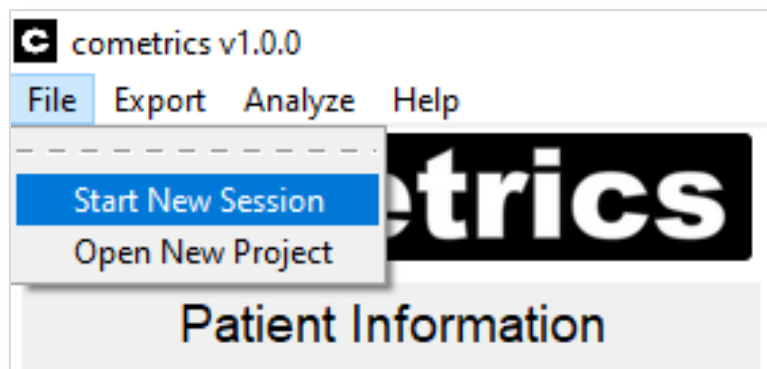


- To turn on the **Webcam** or other connected camera, press **Select Camera** and choose the desired input

- 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

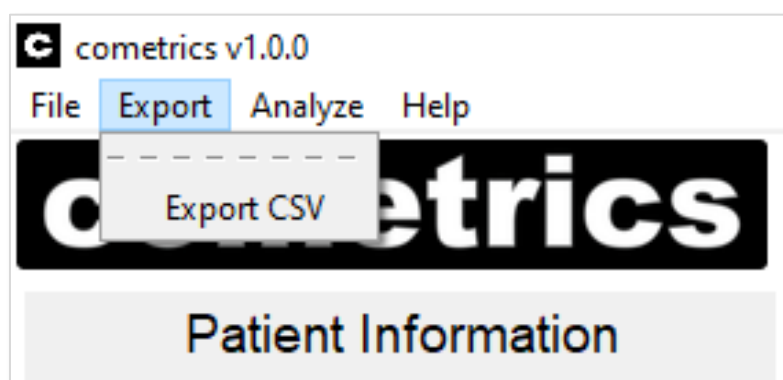


## Section 10 Quick Access Menu

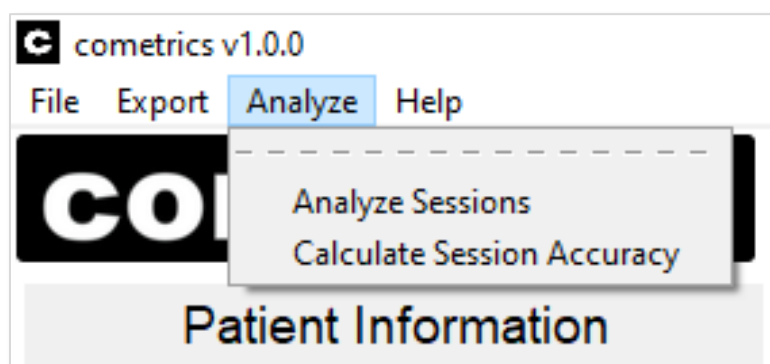


**Start New Session** – Reset the coding UI with the same settings

**Open New Project** – Close the coding UI and restart cometrics

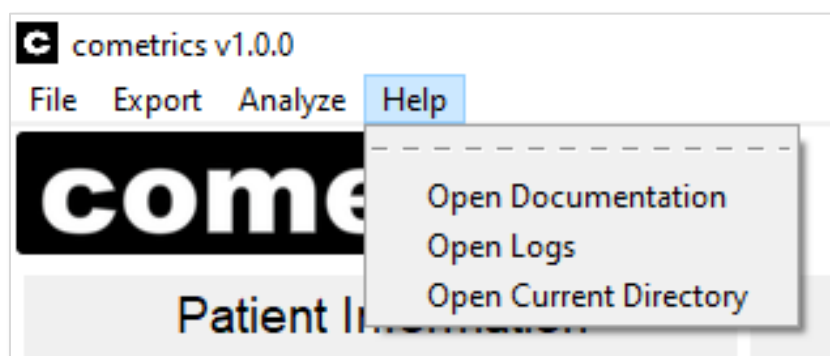


**Export CSV** – Used to export all existing session data for the patient into CSV files



**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

## Section 11      Keystroke File Format

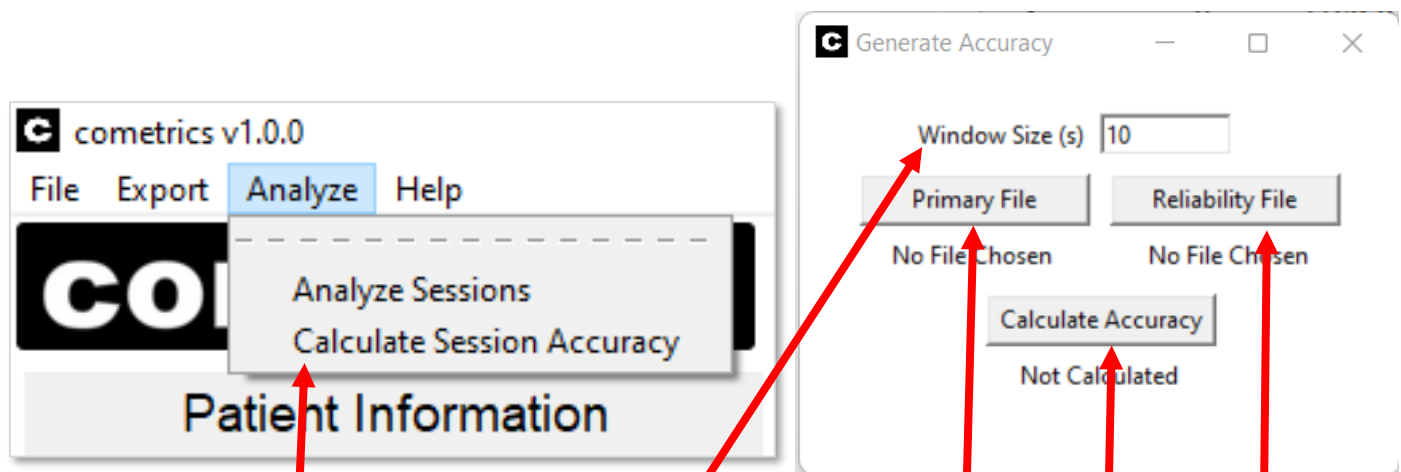
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
1	Assessment:									Session Data												
2	Client:			Data Coll.						Frequency						Duration						
3										q	w	e	r	t	y	a	b	c	d	e	ST	PT
4	Session	Cond.	Date	Therapist	Primary	Reliability	Notes	Sess. Dur. (mins)		Freq 1	Freq 2	Freq 3	Freq 4	Freq 5	Freq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

#### Frequency Keys Partial Interval Agreement Percentage (PIA)

For each interval,  $x = \text{smaller value} / \text{larger value}$

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,  $x = \text{smaller value} / \text{larger value}$

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

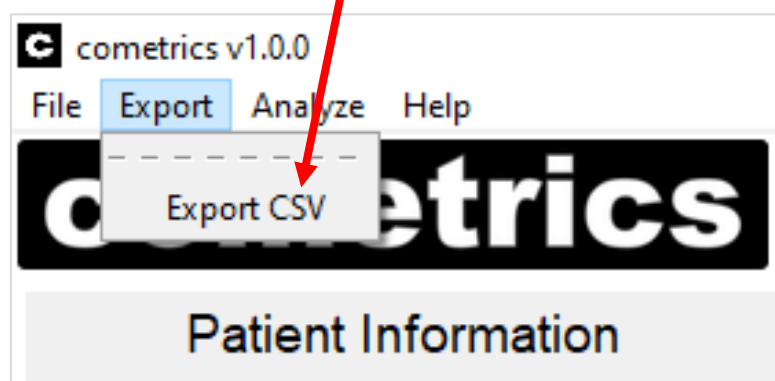
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Each session has an output file that lists all collected information during a session including the Patient Information fields, keystrokes logged with timestamps from the timer, E4 frame, and video frame, where applicable, as well as all E4 data organized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

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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.

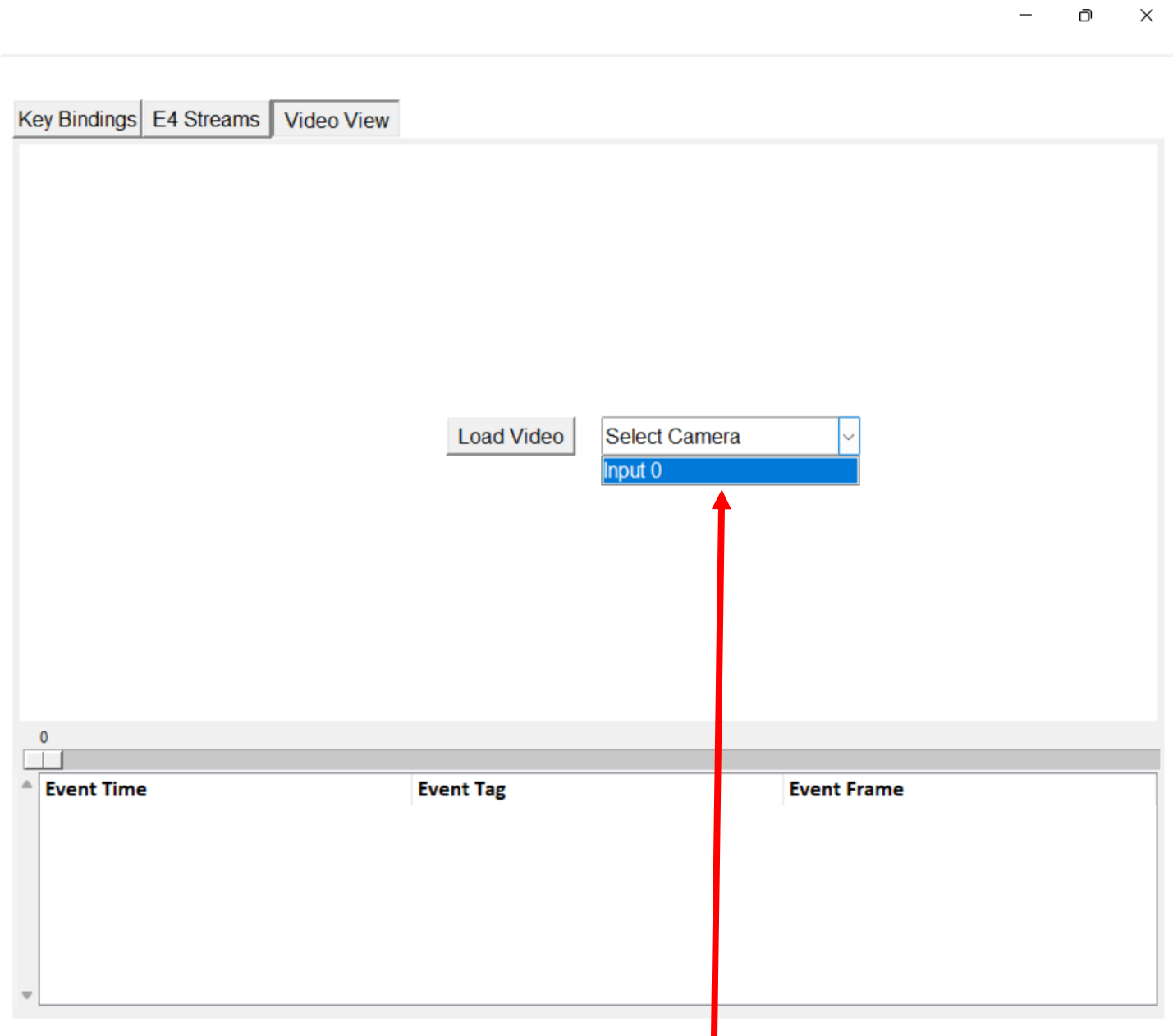
The E4 checkbox enables the recording of Empatica E4 data. The Woodway checkbox enables the control of a Woodway Split Belt Treadmill. The BLE checkbox enables the control of a BLE peripheral device.

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

The “Clear Recent Projects” will delete all of 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 in the order that cameras are found

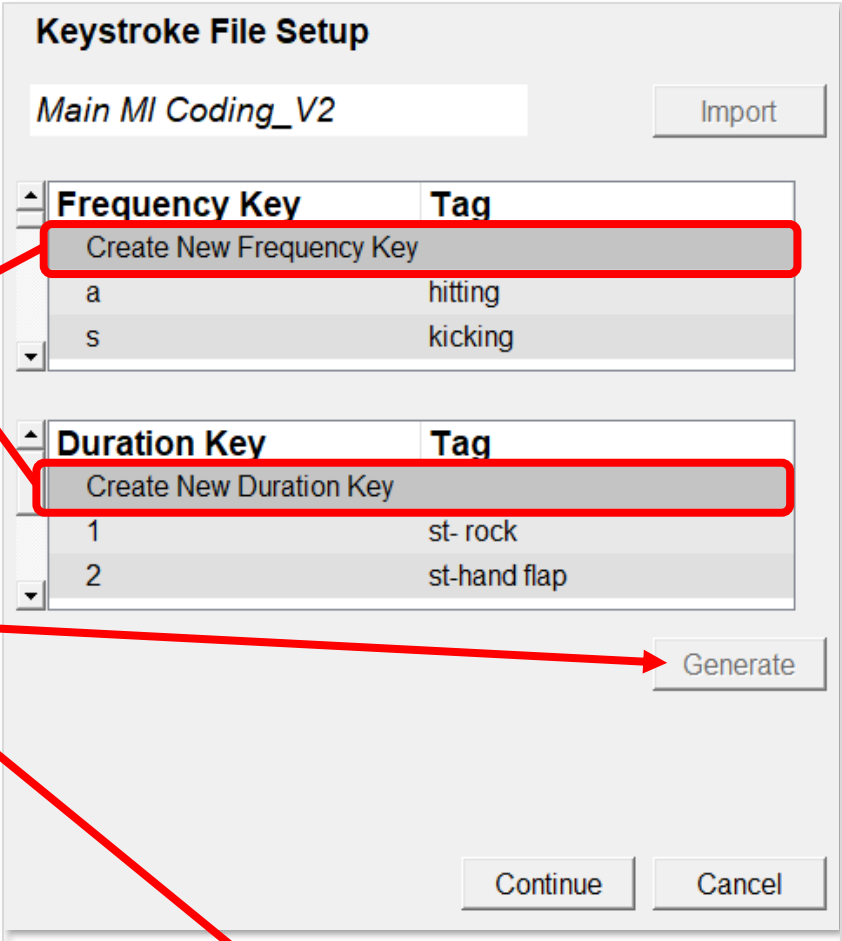
Generally, this order is the same each time given the same cameras being connected, but there is no way to differentiate between cameras

The user will have to test 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 this way, the “Generate” button will be interactable and a popup will show



The 'Keystroke File Setup' dialog box shows a file named 'Main MI Coding\_V2'. It contains two tables. The first table, 'Frequency Key', has a 'Create New Frequency Key' button highlighted in red, and a list with 'a' (hitting) and 's' (kicking). The second table, 'Duration Key', has a 'Create New Duration Key' button highlighted in red, and a list with '1' (st- rock) and '2' (st-hand flap). A 'Generate' button is located to the right of the tables, and 'Continue' and 'Cancel' buttons are at the bottom.

Frequency Key	Tag
Create New Frequency Key	
a	hitting
s	kicking

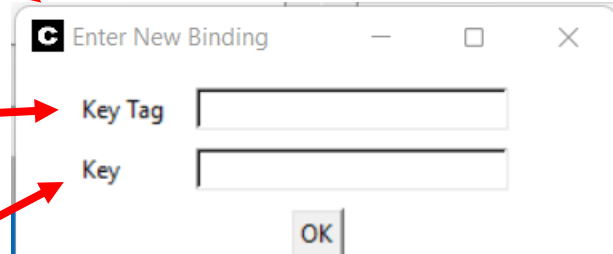
  

Duration Key	Tag
Create New Duration Key	
1	st- rock
2	st-hand flap

**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



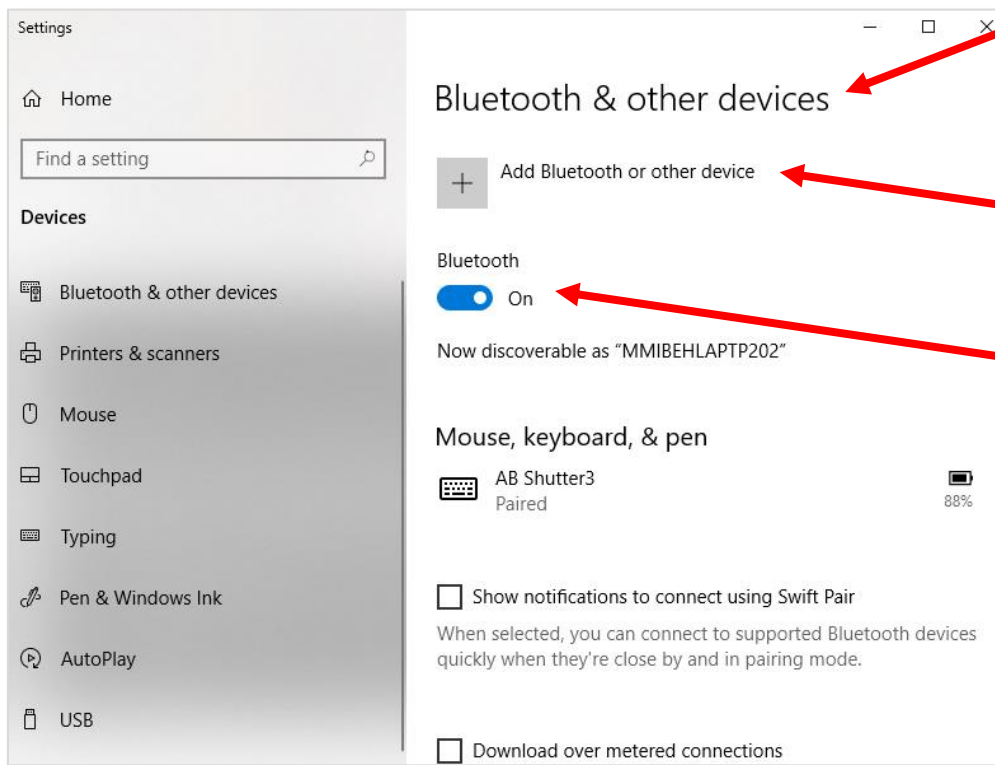
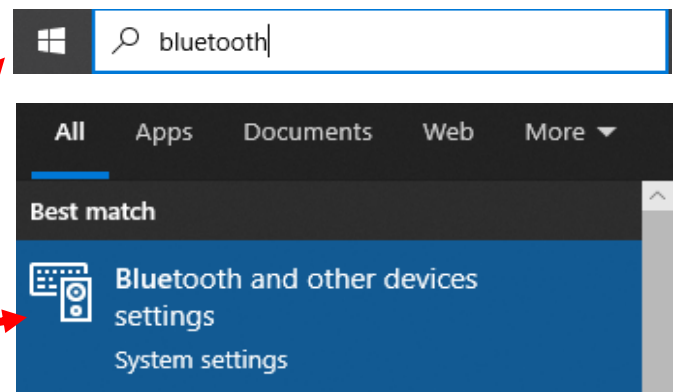
The 'Enter New Binding' dialog box has two input fields: 'Key Tag' and 'Key'. An 'OK' button is at the bottom.



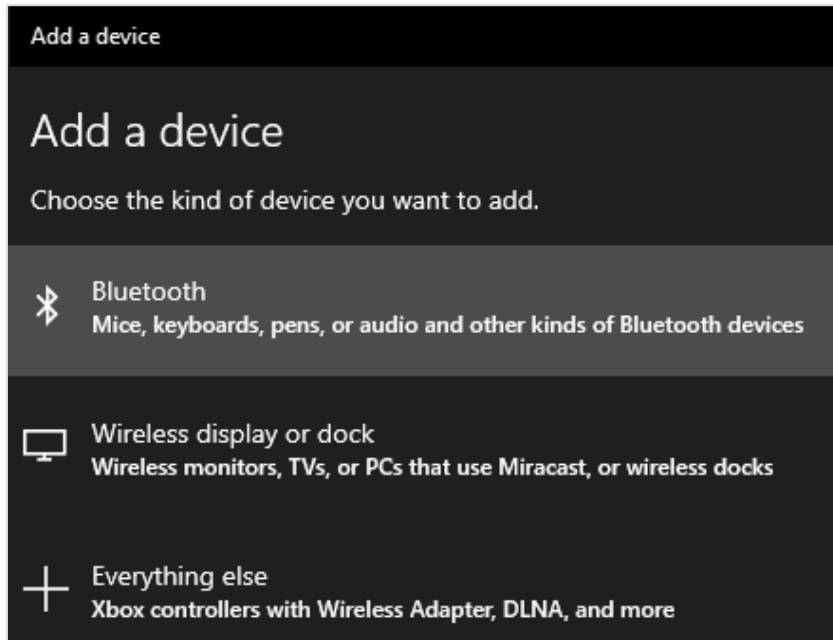
## Section 17 Connecting External Input

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

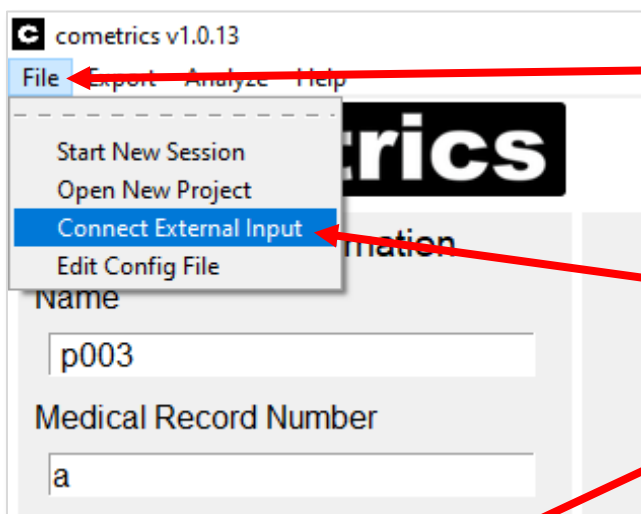
- First, the user must **connect** the desired device to their computer **via Bluetooth**
- In the Windows search bar in the bottom left, search for “**Bluetooth and other devices settings**”
- Click to open system settings



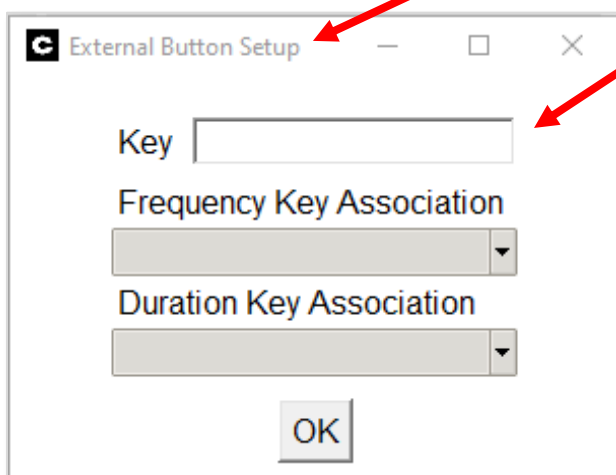
- The “Bluetooth and other devices” window will open
- Select “Add Bluetooth or other device”
- Make sure Bluetooth is turned on



- 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

- 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:

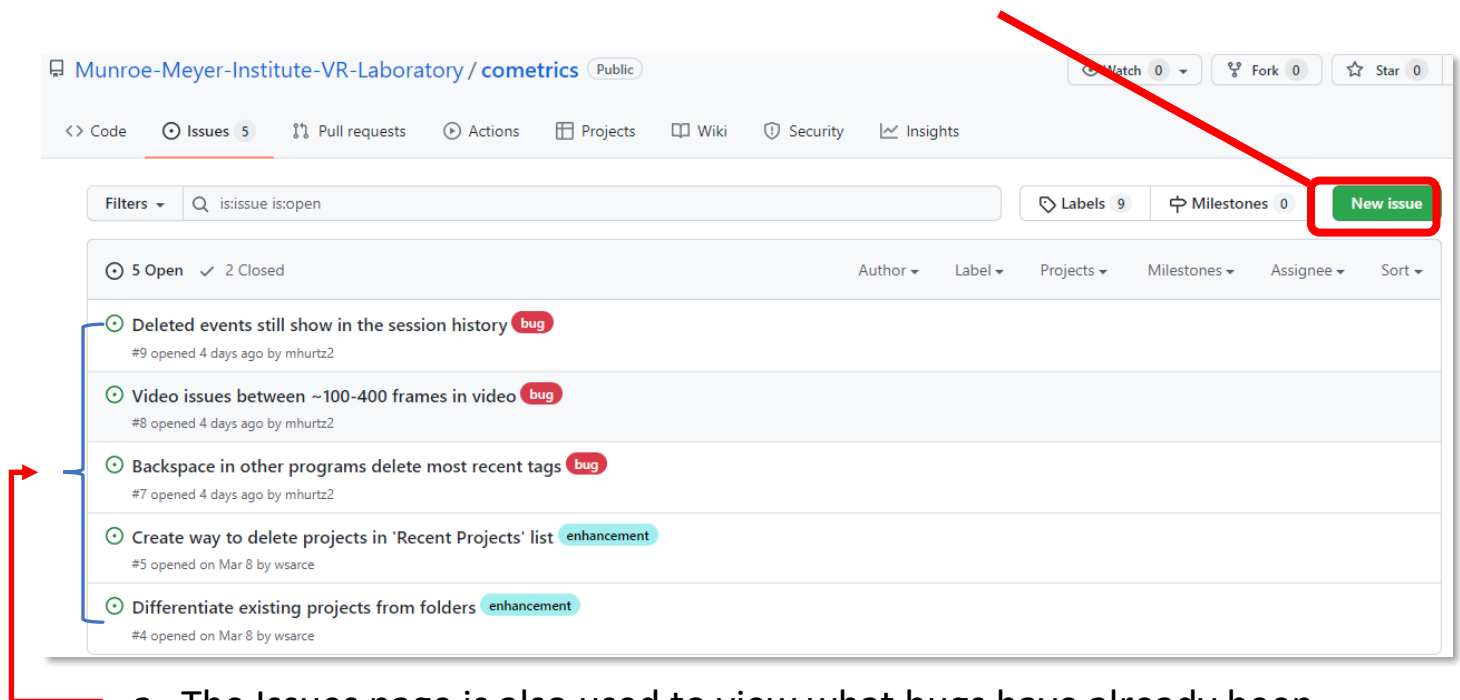
1) Create or login to a GitHub account

[https://github.com/login?return\\_to=https%3A%2F%2Fgithub.com%2Fjoin](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

The screenshot shows the GitHub interface for the repository 'Munroe-Meyer-Institute-VR-Laboratory / cometrics'. The 'Issues' tab is selected, showing a 'Submit new Issue' form. The form includes a 'Title' field, a 'Write' tab, a 'Preview' tab, and a large text area for the issue description. The right sidebar shows 'Assignees' (No one assigned), 'Labels' (None yet), 'Projects' (None yet), 'Milestone' (No milestone), and 'Development' (Shows branches and pull requests linked to this issue). A green 'Submit new issue' button is located at the bottom right of the form.

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

This screenshot is an annotated version of the GitHub 'Submit new Issue' page. A red arrow points to the 'Title' field, and another red arrow points to the 'Leave a comment' text area. A red box highlights the green 'Submit new issue' button at the bottom right.

#### 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

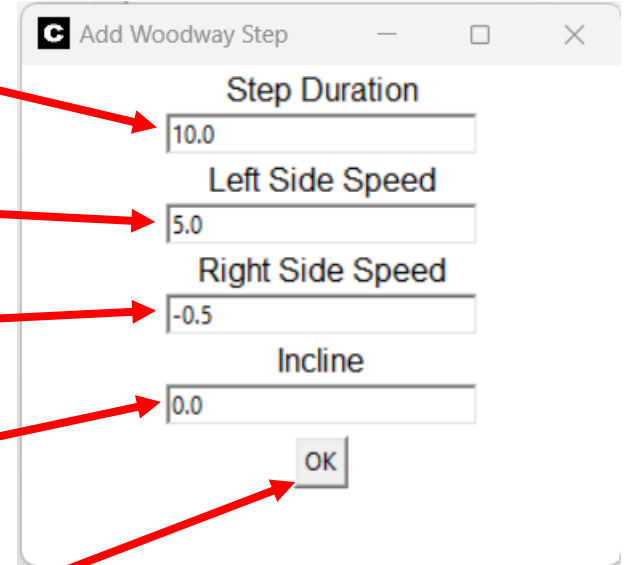
Set the duration in seconds for new protocol step

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



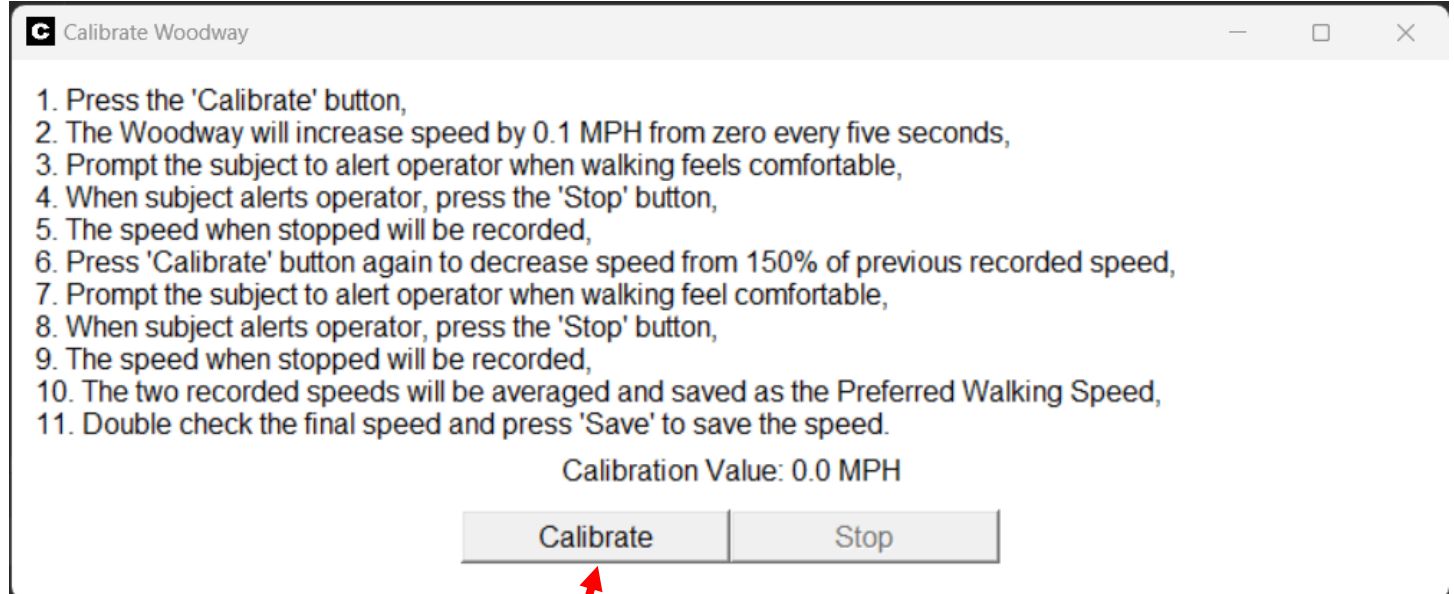
The screenshot shows a dialog box titled "Add Woodway Step" with a close button (X) in the top right corner. Inside the dialog, there are four input fields and an "OK" button. Red arrows point from the text instructions on the left to each of these elements: the "Step Duration" field (10.0), the "Left Side Speed" field (5.0), the "Right Side Speed" field (-0.5), the "Incline" field (0.0), and the "OK" button.

Field	Value
Step Duration	10.0
Left Side Speed	5.0
Right Side Speed	-0.5
Incline	0.0

OK

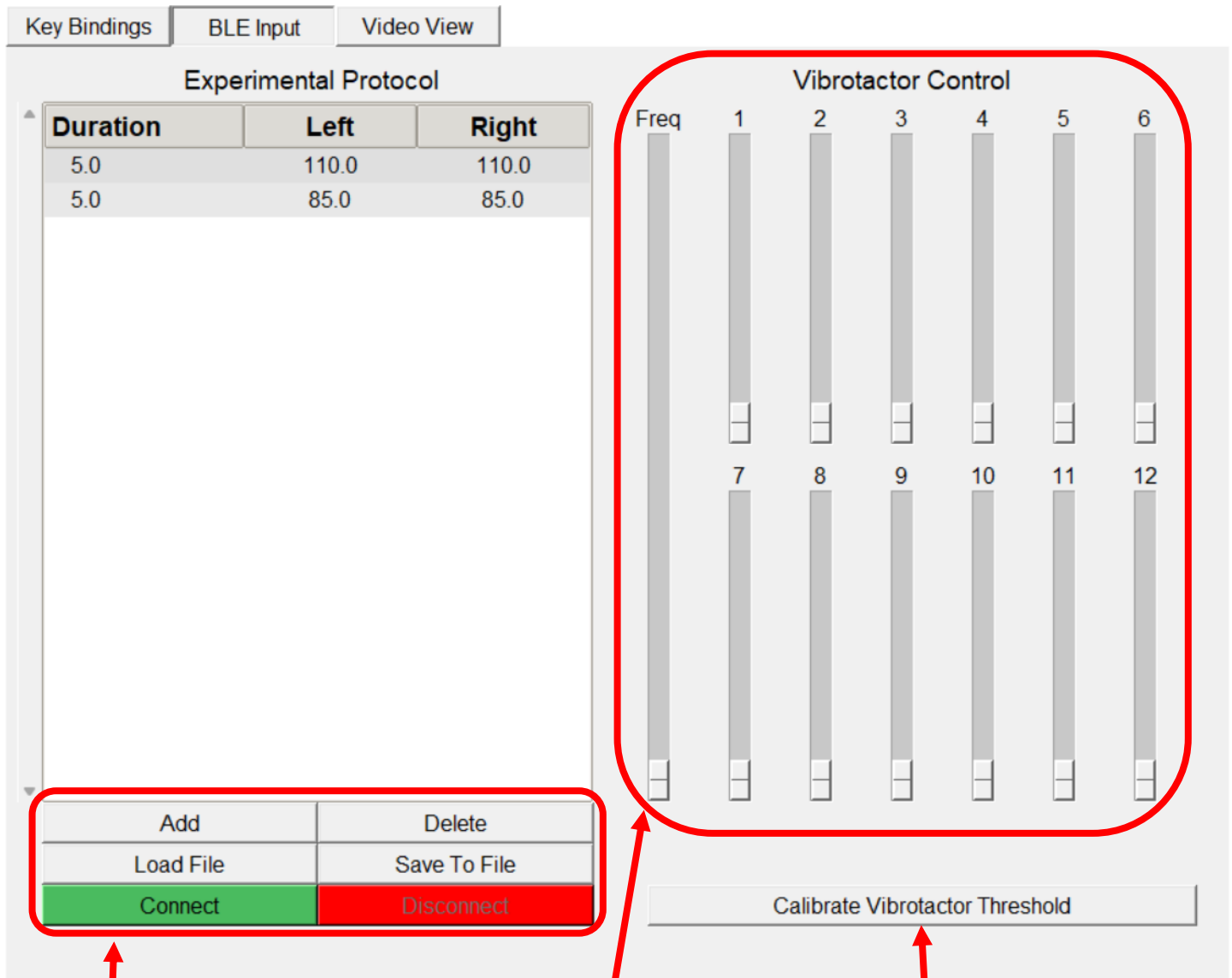
## Section 19

## 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



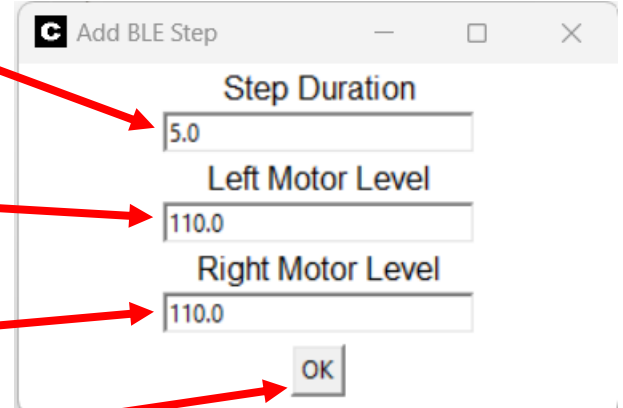
## Section 20 BLE Peripheral Support

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

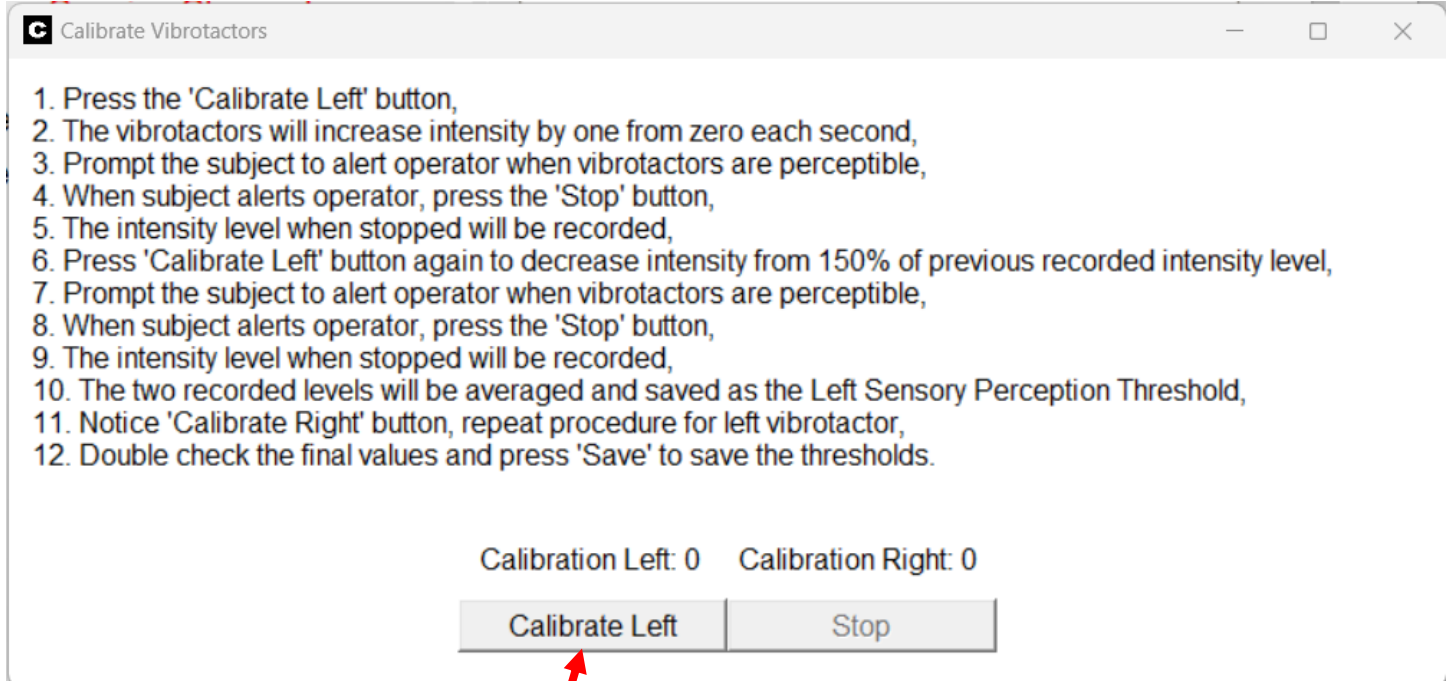


The image shows a screenshot of a software dialog box titled "Add BLE Step". The dialog box contains three input fields and an "OK" button. Red arrows from the text on the left point to each of these elements: the first arrow points to the "Step Duration" field (containing "5.0"), the second arrow points to the "Left Motor Level" field (containing "110.0"), and the third arrow points to the "Right Motor Level" field (containing "110.0"). A fourth red arrow points from the "Add the protocol step" text to the "OK" button.

Field	Value
Step Duration	5.0
Left Motor Level	110.0
Right Motor Level	110.0

## Section 20

## BLE Peripheral Support



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