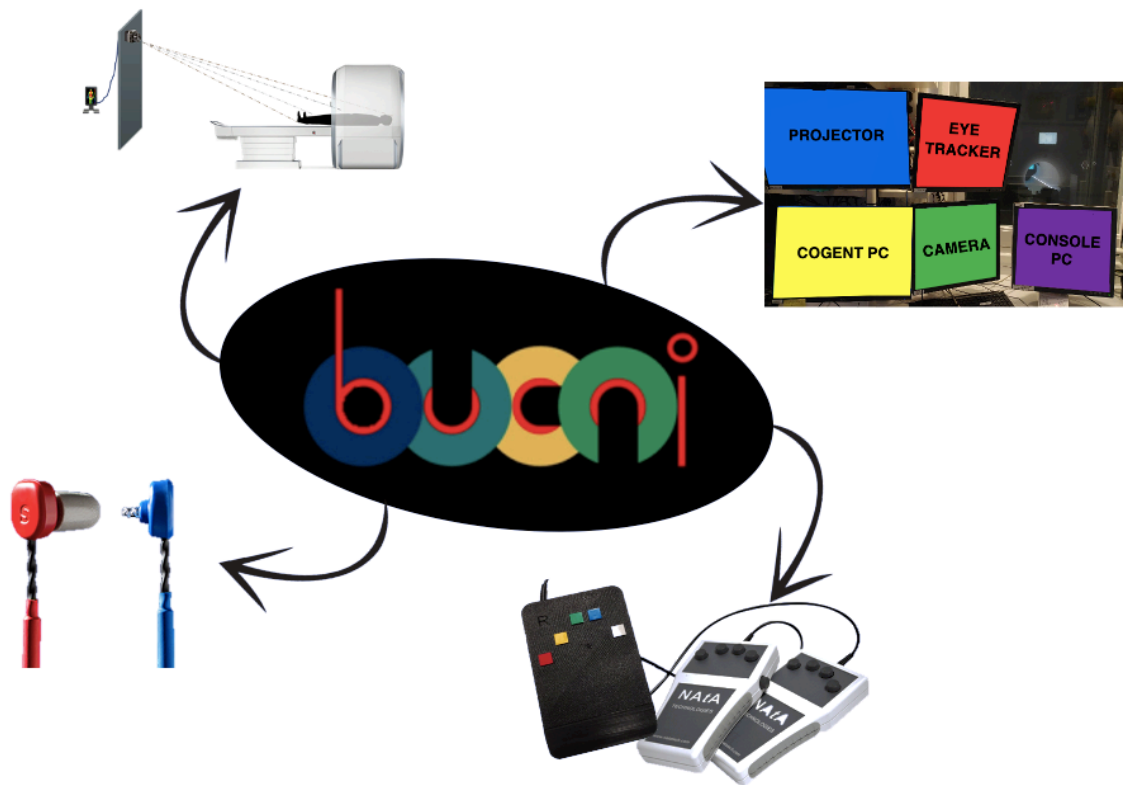


# ***STANDARD EQUIPMENT***

## ***3T PRISMA SCANNER***



Written by Davide Bono

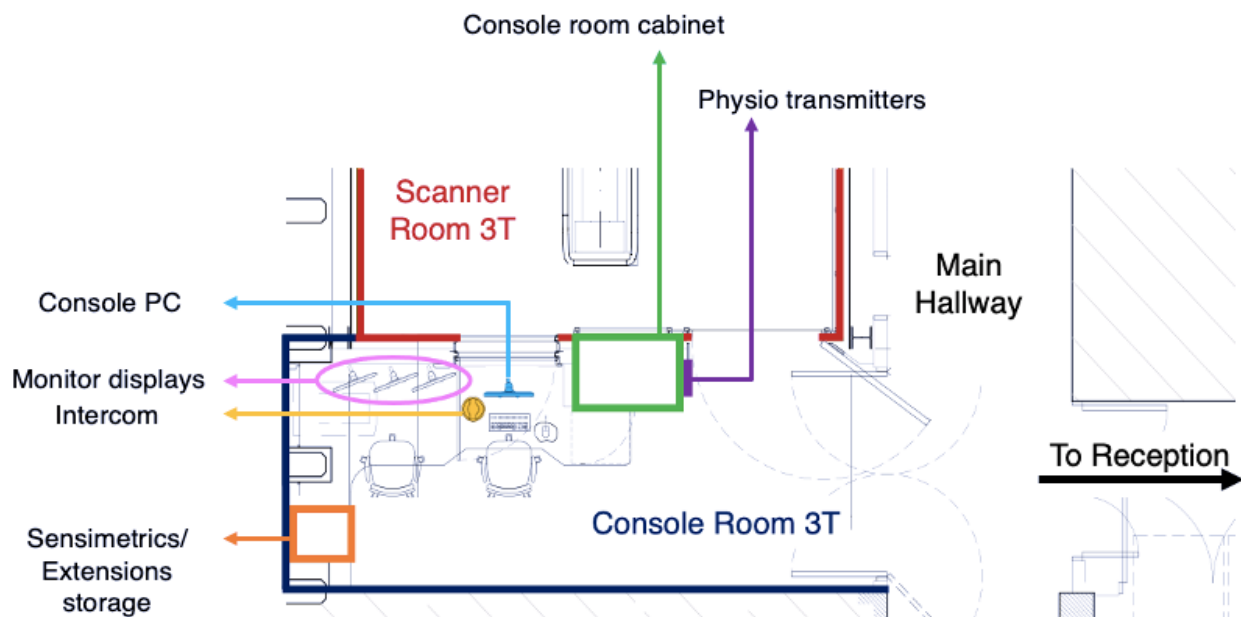
Version 1, 29 July 2021

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# *Console room map*

## *Location of different pieces of equipment*

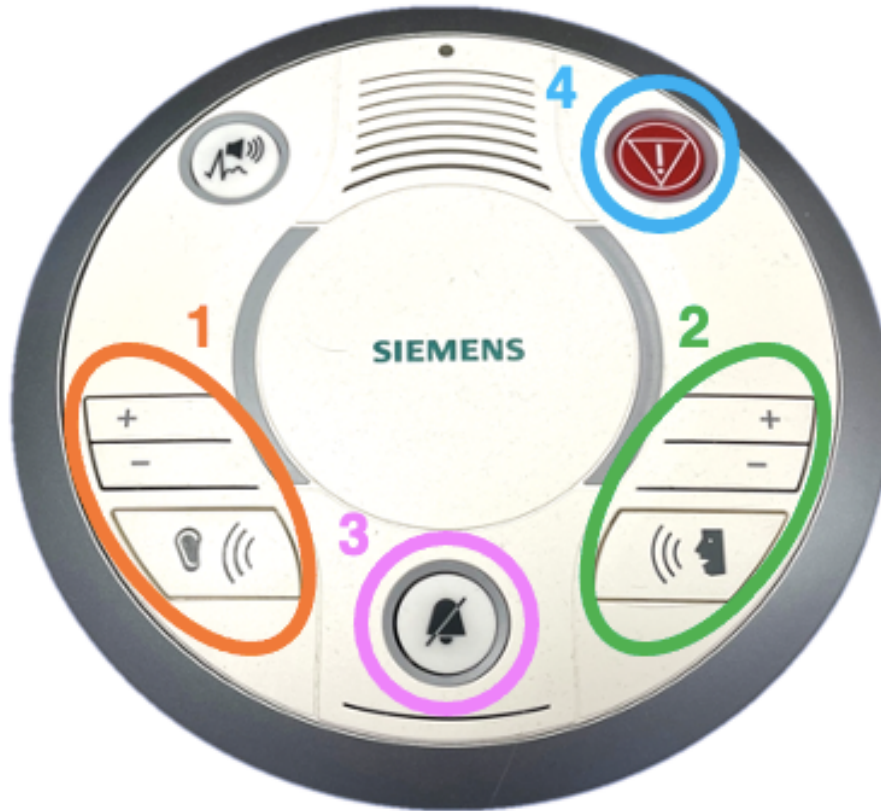


# ***Section A***

## ***Communication and monitoring devices***



# *Intercom*



The Siemens intercom is a device that allows you to communicate with the participant when they are inside the scanner bore and you are in the console room.

To use the intercom, keep in mind the following notes:

1. Press the “Listen button” (#1) to hear what the participant has to say when they are inside the scanner room. Feel free to use the + and – keys to adjust the volume.

**PRACTICAL TIP:** Remember to turn down the volume when scanning, it can be quite noisy!

2. Press the “Talk button” (#2) to talk with the participant. Feel free to use the + and – keys to adjust the volume in case participants report your voice as being perceived either too soft or too loud.

**PRACTICAL TIP:** Remember: the intercom is a unilateral system. You can either talk with the participant or hear what they have to say. ***You can't hear them talking if you are talking to them at the same time.*** To be sure not to miss any of their words to you, have a look at the infrared camera when talking to your participant. If you see that they are trying to talk while you are talking with them, release button 2 and pay attention to what they have to say!

3. Press the “Stop button” (#3) to clear the emergency alarm triggered by the squeeze ball.

**PRACTICAL TIP:** If the squeeze ball is pressed by the participant when scanning, follow the following steps:

- A) Stop the scanner using the mouse and clicking the stop icon in the lower left on the console screen.
  - B) Press the talk button (#2) to talk to your participant
  - C) Release the talk button to hear what the participant has to say (and make sure that the Listen button (#1) is enabled!)
4. By pressing the “Manual button” (#4) on the Siemens Intercom, you can activate the manual operation mode of the scanner bed. The manual operation mode of the bed allows you to extract the bed only manually, by pulling the scanner bed out of the bore towards you. To pull the bed out of the scanner manually follow the following steps:
    - A) Press the manual button (either in the siemens intercom or on either side of the scanner bed)
    - B) Go in the scanner room and pull the emergency release located at the bottom right of the fixed table (1)
    - C) Use the handle at the foot of the sliding bed to pull the participant out



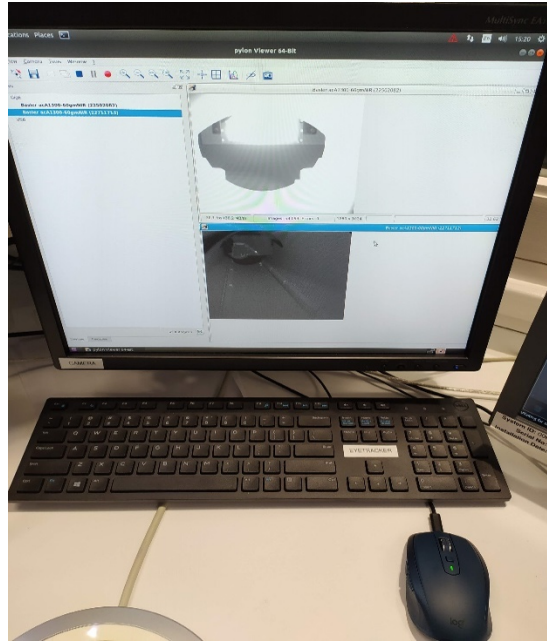
***This button must be used only in case of emergencies!*** After, the manual button is pressed, you will need to restore the scanner bed to resume the automatic operation mode of the scanner bed.

***PRACTICAL TIP:*** To reset the scanner bed, go into the scanner room and simultaneously press the Table Up and Table Down button for ~30s.



Finally, press the Home button to complete the resetting process Detailed instructions will pop up on the scanner monitor.

# *Infrared camera*



*Camera display. The infrared camera is automatically oriented to the location of the head coil.*



## ***Set up procedures***



1. Turn on the illuminator by pressing the power button on the top shelf of the console room cabinet.



2. Double-click Scanner camera icon on the Desktop of the camera pc



3. Select the camera you want to use
4. Select continuous shot



5. You can make the image full screen, zoom in, add a grid as appropriate

Please note that you can use both infrared cameras during scanning. Lights can be turned off during the scan.



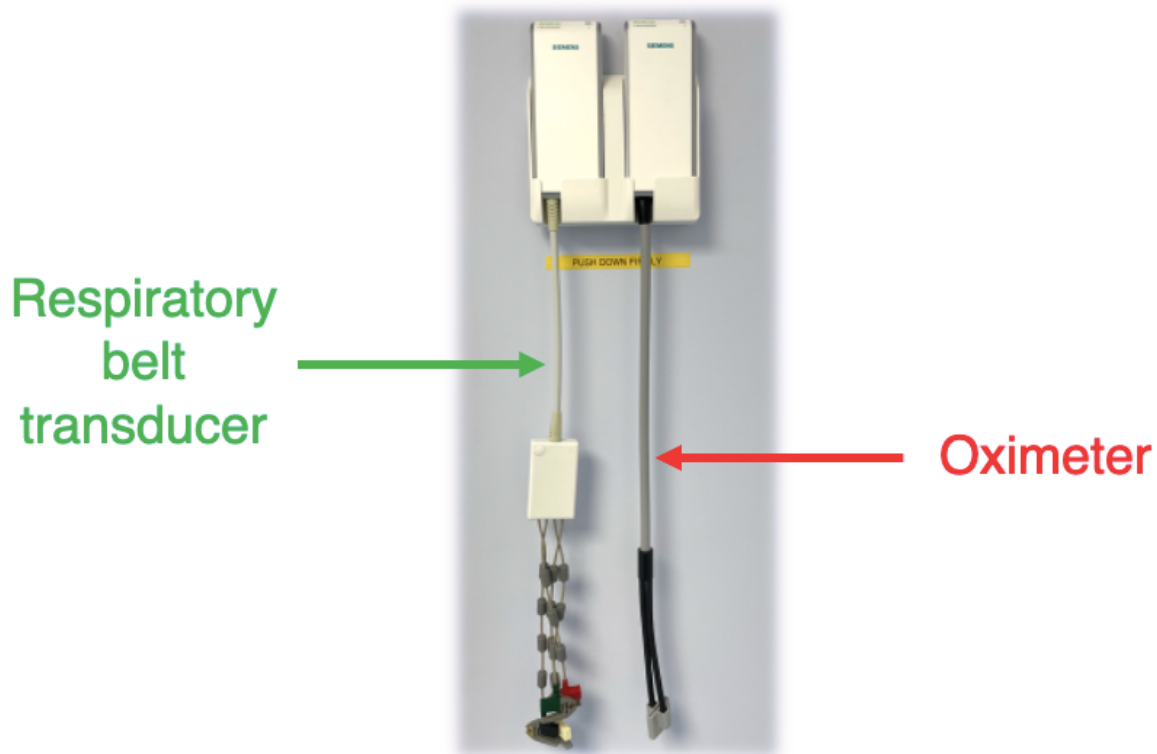
## ***Troubleshooting***



The image quality should already be optimized for each camera by the specified default parameters. However, if the image quality is not good, check the following:

- ***Is the illuminator on?***  
Can you see the red lights on the illuminator in the scanner room? If they are off, please check inside the cabinet in the console room that the illuminator is switched on. If everything is on but the illuminator does not work, please contact BUCNI staff.
- ***Is the illuminator in the scanner room occluded?***  
Do not touch it or move it but let BUCNI staff know if there is any issue.
- ***Are the default settings loaded correctly?***  
Reload the default settings to overwrite previous changes by doing the following: Stop image acquisition ■ -> click on Camera -> load features -> click on default parameters -> open -> start recording again to see changes. Make sure you select the parameters corresponding to the correct camera.
- ***Is the participant body occluding the light (e.g., body creates shadow on participant face)?***  
Consider if it is possible to adjust the participant. If necessary, change the acquisition features, for example by increasing exposure time. **IMPORTANT** if you do change the features manually or if you press auto-adjust – make sure that you restore the default settings.

# Physiological data recording



When scanning at BUCNI, we strongly recommend to also monitor the physiological parameters of your participants, such as their pulse and their respiration throughout the testing session.

To do so, you can use the respiratory belt transducer and the oximeter. Both controllers can be found on their charging station, on the wall of the console cabinet that faces the scanner room door (also see Console room map).

**PRACTICAL TIP:** Make sure to push both controllers firmly down when putting them back in the charging station. Failure to do so might prevent the controllers from being fully charged, thus making them unusable for following scanning sessions.

## Warning!

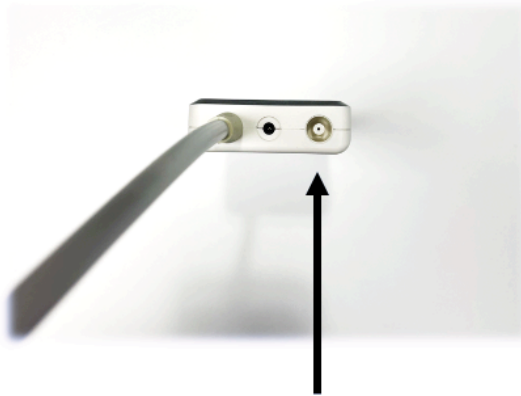
The following guidelines enable you to only record and ***NOT*** save physiological data. To make sure that the sequence you are using is storing physiological data and to retrieve physiological data after testing, please be in touch with a member of BUCNI staff.



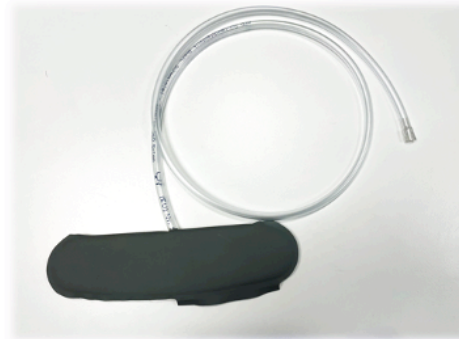
## ***Set up procedures – Respiratory belt***



The respiratory belt transmitter has 4 non-detachable electrodes for ECG and one port for the breathing sensor. The breathing sensor, altogether with all the other physio-related equipment mentioned below can be found in the cabinet located on the left of the scanner within the scanner room.

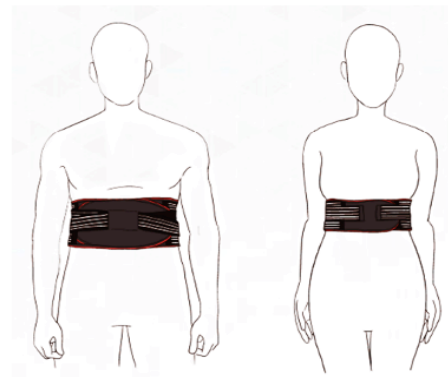
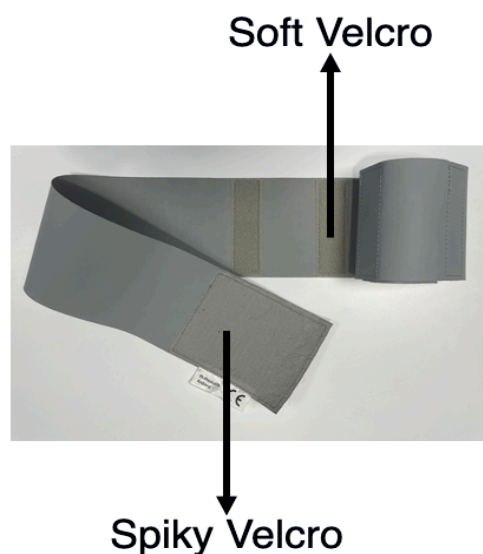


**Sensor port**

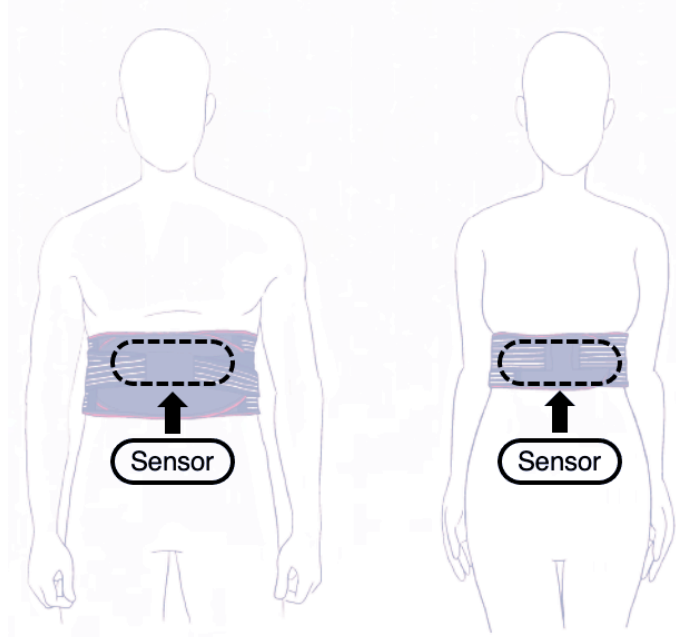


**Breathing sensor**

1. Invite the participant to wear the respiratory belt. Advise them that the soft Velcro stripes should not face the body, so as to allow the spiky Velcro stripe to fasten the belt accordingly. The belt should be worn *AS TIGHT AS COMFORTABLE* and just below the chest as shown in the picture below.



2. Ask the participant to place the breathing sensor below the respiratory belt. The sensor should be inserted from the lower edge of the belt and lay horizontally underneath the belt as shown in the figure below.



3. Plug the cable of the breathing sensor into the breathing belt transmitter.
4. Rest the transmitter on the plastic case and place the case on the scanner bed. Try to rest the unused ECG electrodes on the case and not on the body of the participant.



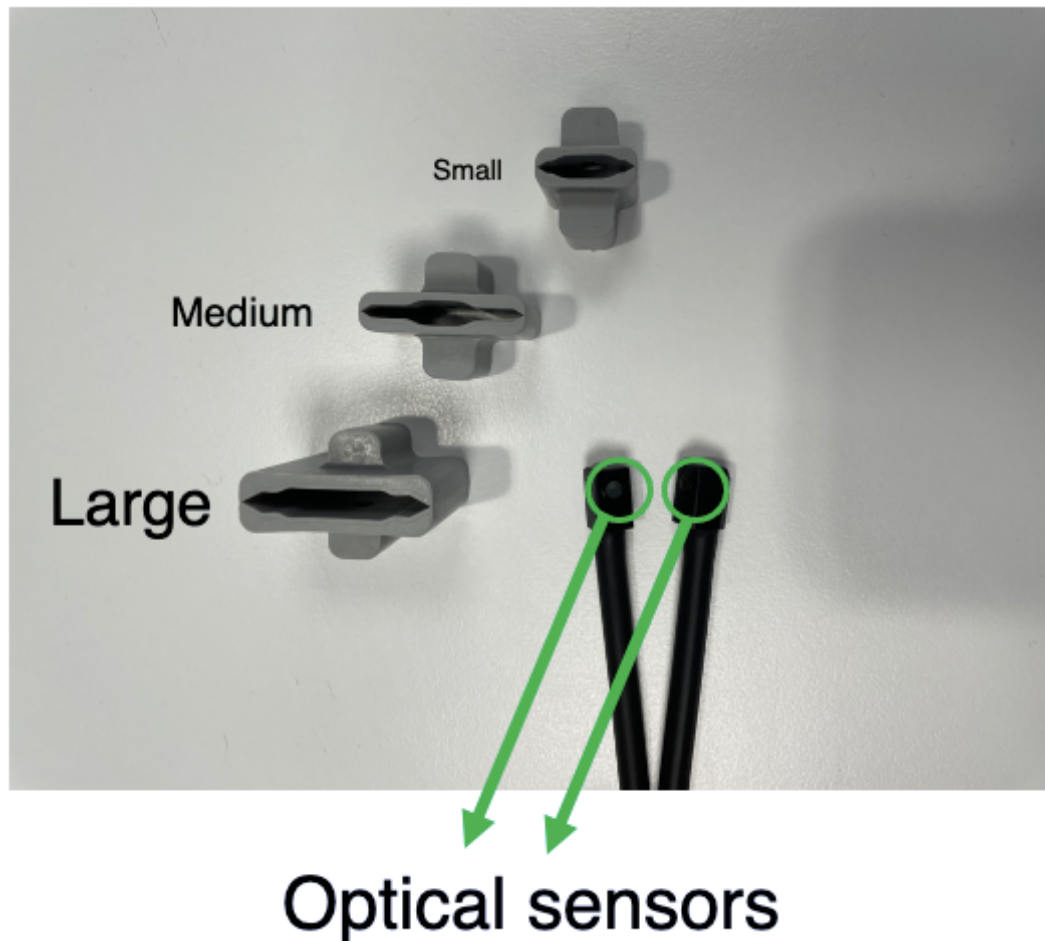


## ***Set up procedures – Oximeter***



1. Insert the index finger in the plastic ring of the oximeter.

***PRACTICAL TIP:*** If you are running an experiment that involves tactile stimulations being delivered on the index finger, bear in mind that the oximeter can be applied to any other finger or toe. The default size of the plastic ring is medium, but a large and small size can be found in the cupboard to the left of the scanner in the scanner room.



2. Make sure that the optical sensors are properly mounted within the plastic ring and that they are facing each other. Otherwise, the pulse reading will be compromised!



## ***Troubleshooting***

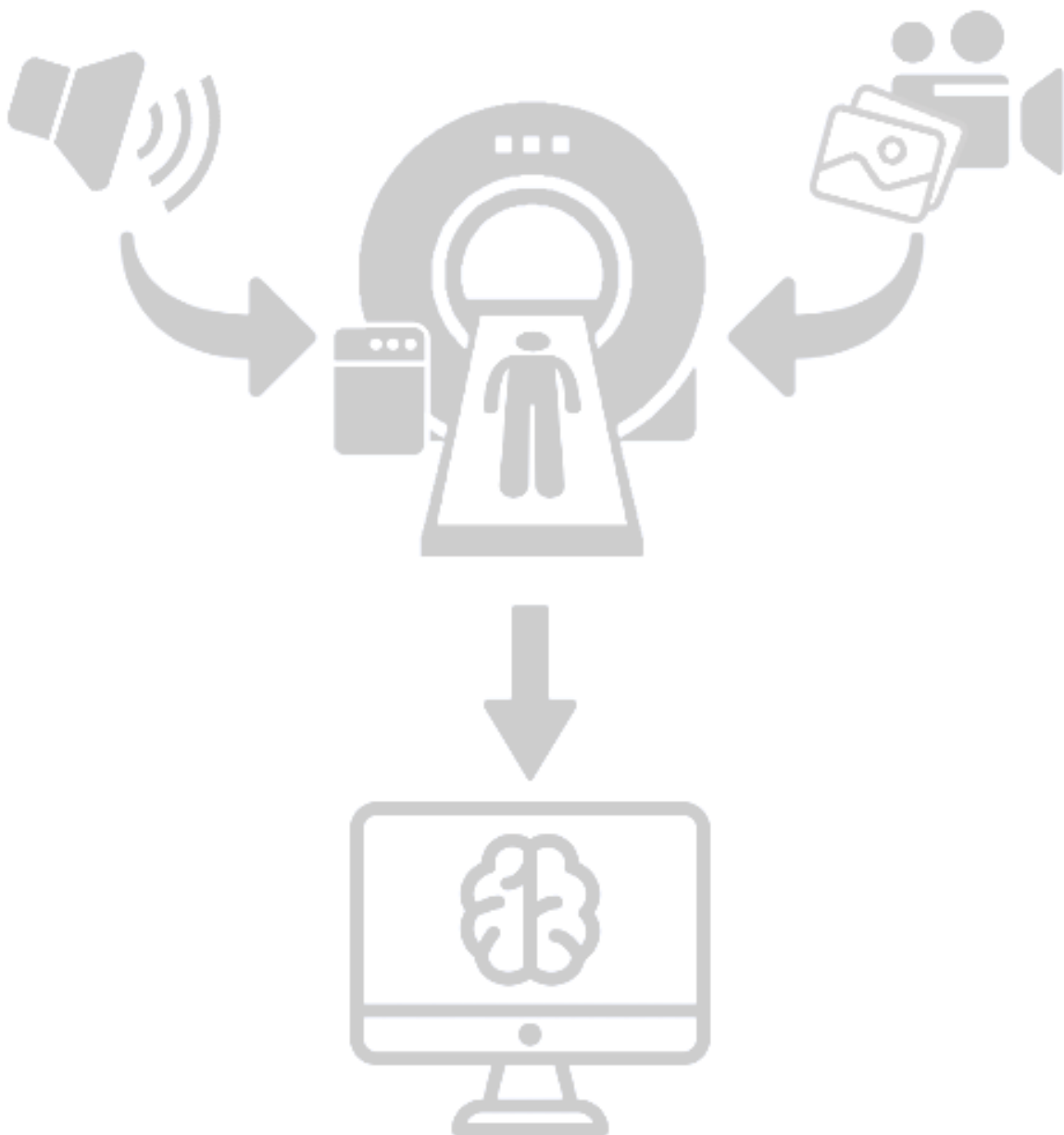


The scanner monitor will automatically show the reading of the physiological parameters recorded (breathing and pulse) after 1-2 minutes of initial learning/calibration phase. However, if the physiological reading does not appear on the screen correctly, check the following:

- ***Are the optical sensors facing each other?***  
Check the oximeter and make sure that the optical sensors are facing each other, and they are not covered (even partially) by the plastic layer of the plastic ring.
- ***Is the plastic ring too loose?***  
Feel free to use the appropriate size of the plastic ring for the oximeter. Failure in doing so might compromise the pulse reading.
- ***Are participants' hands too cold?***  
The oximeter indirectly measures the pulse by monitoring changes in the temperature of participants' fingers which are induced by blood flow. If the baseline temperature of participant's hand is too low, that might impede the pulse recording. We recommend using a blanket to increase the temperature of participant's hand and attempt the recording again.
- ***Is the breathing belt tight enough and positioned below the chest?***  
If the breathing belt is mislocated or worn too loose, that might impede the breathing sensor from recording participant's breathing.
- ***Is the participant still?***  
After the initial learning/calibration phase, physiological sensors start recording. If the participant is moving, that might disrupt the recording. Invite the participant to stay still and observe the reading for a few seconds to check whether it shows a regular and repetitive pattern.

# ***Section B***

## ***Presentation of visual and auditory stimuli***





# ***Projector and monitor displays***



*There are currently 5 displays in the console room: PROJECTOR, COGENT, CAMERA, EYETRACKER, CONSOLE PC.*



*Display switch and remote. Make sure you select the appropriate source to display to your participants in the scanner. Select the same source on the scanner projector (TV1) and the PROJECTOR display in the console room (TV2).*

*An HDMI cable is provided and adapters can be found on a transparent plastic box in first drawer of the Sensimetrics/Extension storage*





## Set up procedures



### PROJECTOR

Turn on and off the projector pressing the On and Standby buttons respectively. These are the only two buttons you should press on the remote. Make sure you point the remote at the black receiver behind the displays in the console room.

Do **NOT** change the setup of the projector from the default settings by pressing buttons on the projector remote.

Please note that, by default, the **Aspect** should be set to “native”.

**The refresh rate of the projector is 60Hz.**



### CONSOLE ROOM DISPLAYS

#### SELECTING WHAT TO SHOW IN THE PROJECTOR DISPLAY (inside and outside the scanner room)

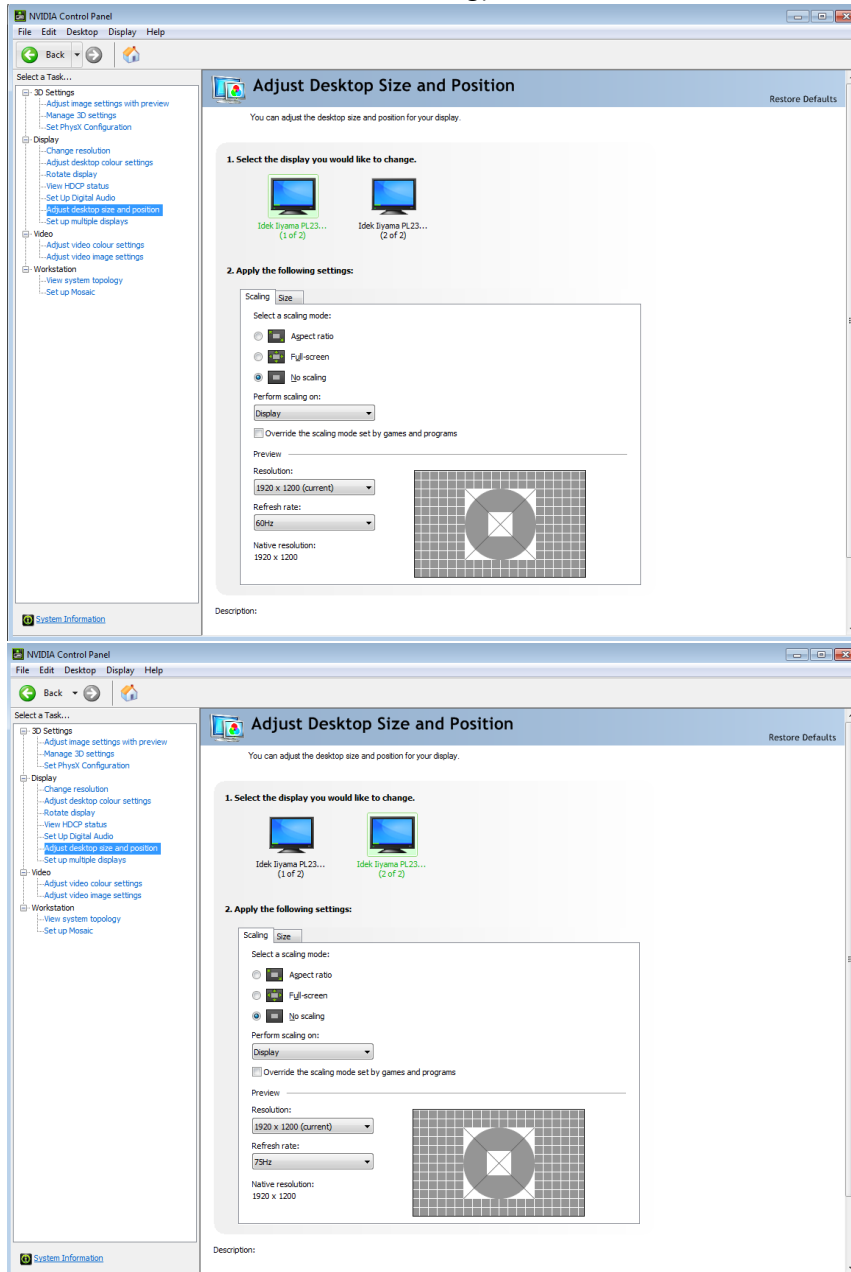
Use the display switch or the corresponding remote to select the source you want to display. Currently you can select from three sources:

- 1 = Cogent PC
- 2 = Laptop – make sure you connect use the correct cable to connect your laptop. Adapters are available on a plastic box in the console room. If you need adaptors that are not already provided, please contact BUCNI staff.
- 3 = Eyetracker PC

Select the same source on the scanner projector (TV1) and the PROJECTOR display in the console room (TV2).

## Using PROJECTOR & COGENT displays with COGENT PC

- Make sure **No scaling** is selected for both the PROJECTOR and the COGENT displays (NVIDIA control panel -> Adjust Desktop size and Position -> No Scaling)



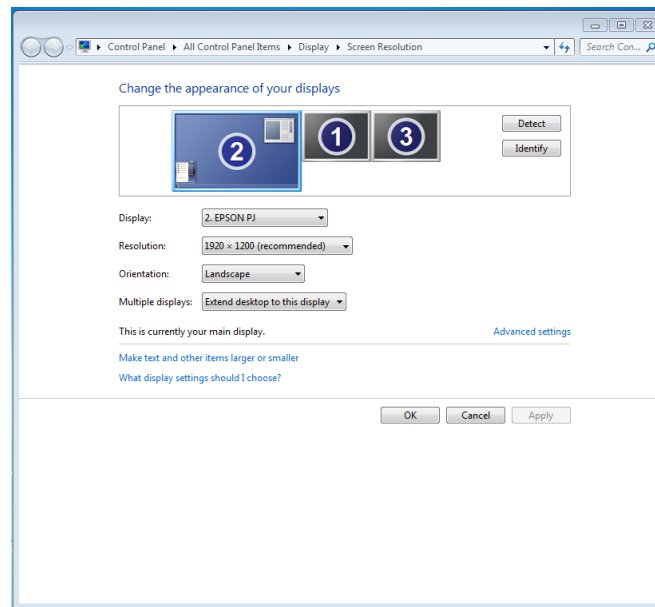
- Use the default resolution (1920x1200) and refresh rate (60Hz) of the display.

## **MULTIPLE DISPLAY SETTINGS**

- ***For accurate timing and visual rendering of visual stimuli using Psychtoolbox, use only the PROJECTOR display***

If using Psychtoolbox, consider that there may be some imprecisions in the presentation of visual stimuli if you use a multi-display setting on Microsoft Windows and Apple Mac OS X. This is a relevant issue for users that need reliable timing and precise visual outputs (e.g., visual psychophysics) and that use Psychtoolbox. The inaccuracies encountered could vary from inaccurate timing in the stimulus presentation to tearing artifacts caused by a failure in synchronization of the displays refresh rate.

To address this issue, we recommend using our stimulus PC with one display only (the display labelled PROJECTOR). This our default setting.



*This is a temporary solution, while we work to implement a permanent change in the setup that allows us to keep a secondary display or a laptop and still guarantees optimal stimulus presentation.*

- Setting up and using ***multiple displays***.

If you need to use a multiple display setting, please consider whether your experiment will be affected by the aforementioned problems. If you do change the display settings, please ***restore BUCNI defaults*** at the end of your session.

# ***Sensimetrics***



Sensimetrics are some MRI-compatible headphones that can be used to play auditory stimuli to the participant when they are inside the scanner bore.

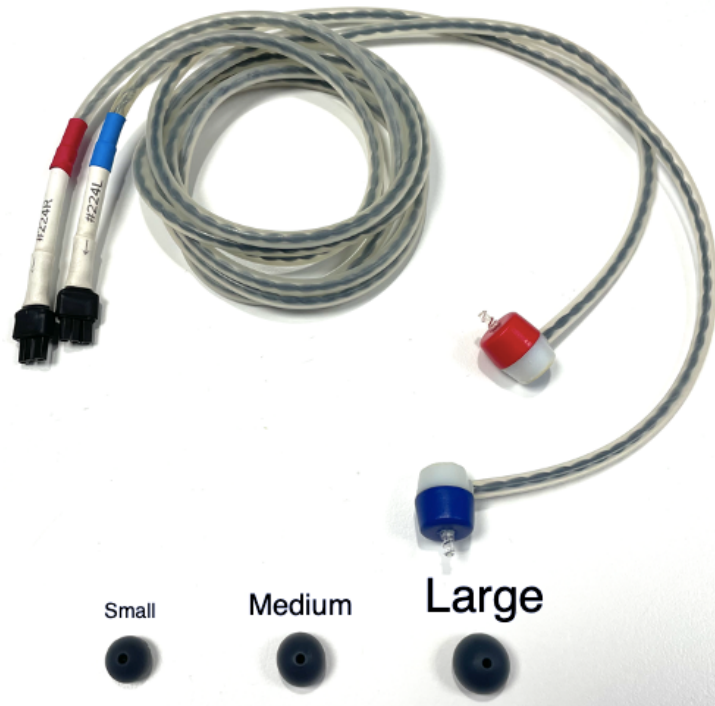
To properly use the Sensimetrics system you need to handle two different components: the headphones and the amplifier.



## ***Set up procedures – Headphones***



- 1) Locate the Headphones within Sensimetrics/Extension storage. They are stored in a plastic box which can be found on the first drawer of the storage unit.
- 2) You will find two headphone cables: the left (blue) and the right (red) cable.
- 3) Mount the appropriate earbud on the tip of each headphone cable. Three different earbud sizes are available: small, medium and large.

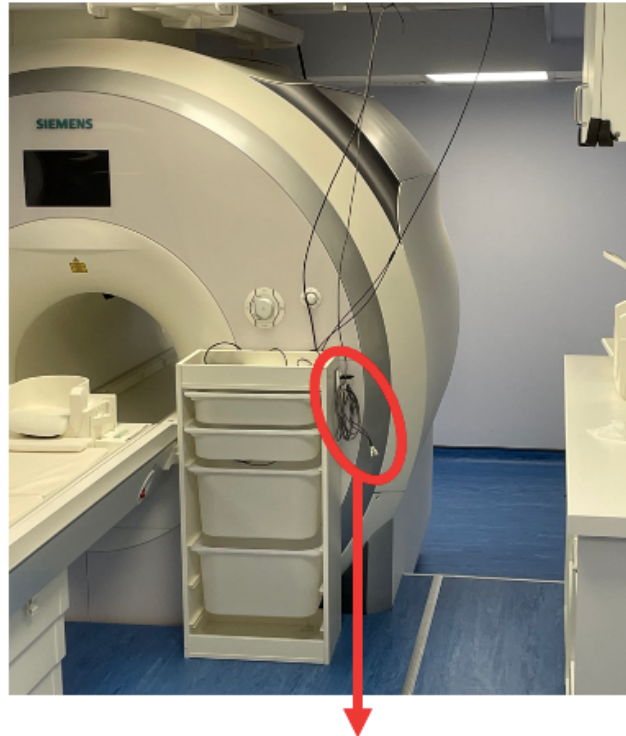


- 4) **Be extra careful when mounting the earbud on each headphone cable. Try to apply not so much pressure with the earbud on the plastic screw. Try instead to gently twist the earbud when inserting that into the plastic screw.**



**Please be careful when mounting the earbud on each headphone cable!!**

- 5) Go in the scanner room and connect each headphone cable to the Sensimetrics cables. The Sensimetrics cable can be found on the right-hand side of the white plastic cabinet on the right of the scanner bed, just underneath the scanner bed operation knob. Two colour-coded cables will be available, one for each headphone cable -blue for left and red for right).



## Sensimetrics cables

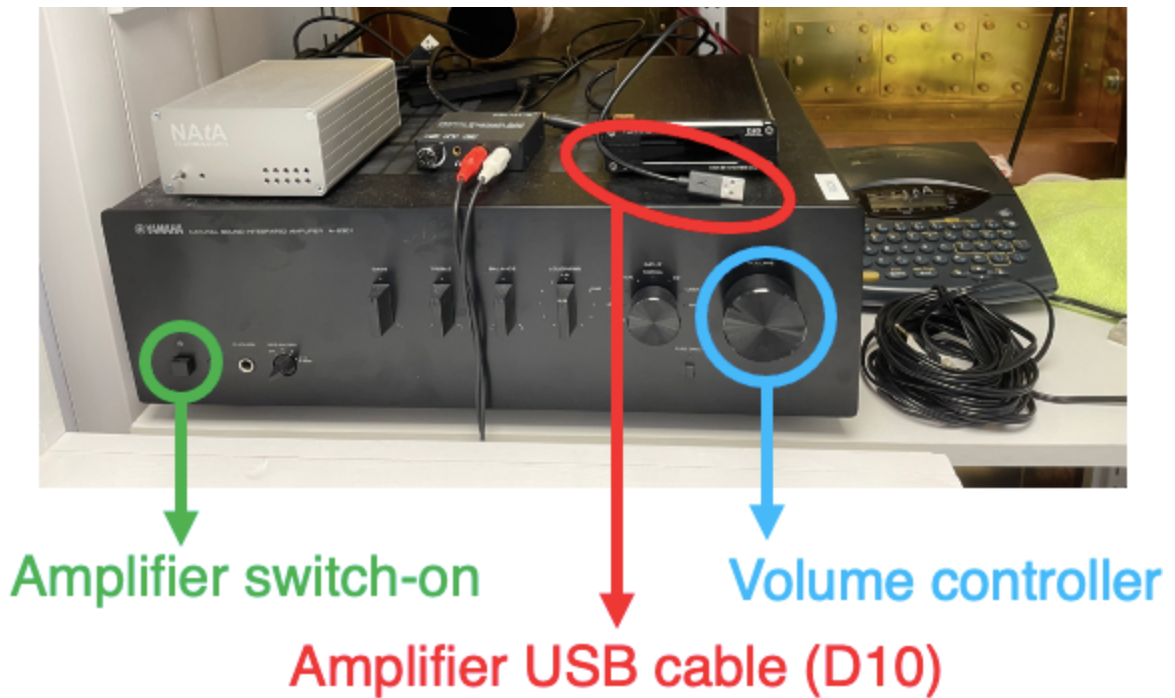
6) Your Sensimetrics headphones are now ready to be used!



## *Set up procedures – Amplifier*



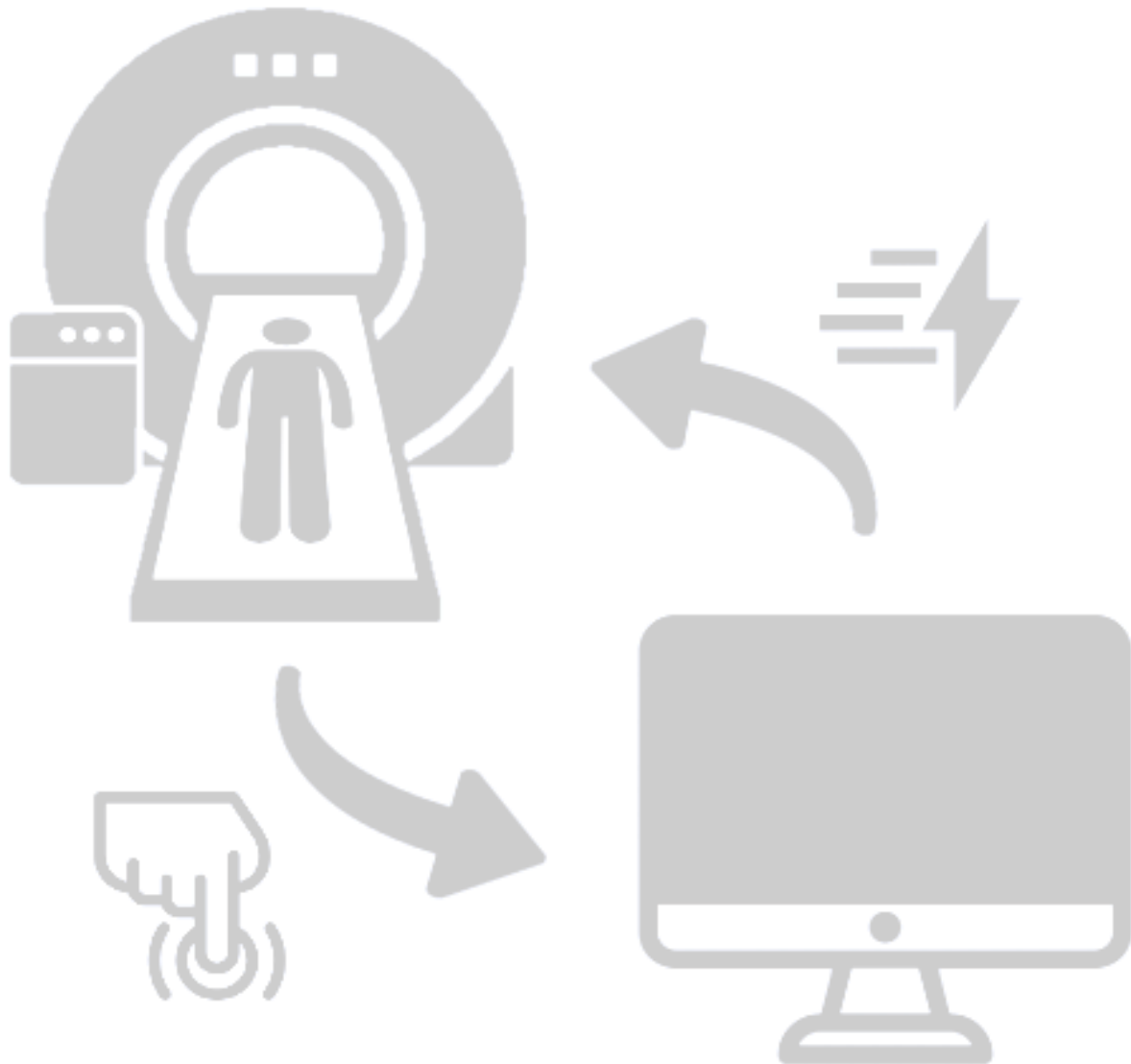
- 1) Locate the Amplifier within the console room cabinet. It can easily be found on bottom shelf of the cabinet.
- 2) Turn **ON** the amplifier.
- 3) Connect the USB cable of the amplifier to your stimulus presentation PC (either testing laptop or Cogent PC).



- 4) Make sure to check the sound settings (either system preferences → sounds on MacOs or Control panel → sound, on Windows) and set the sound output to D10 (D10 is detected as soon as the amplifier is connected to the stimulus presentation laptop).
- 5) ***Check the volume of your sounds before getting the participant in the scanner!***  
To start with the volume knob should be set at 9 o'clock. Up to 10 is still ok but it shouldn't be much higher (otherwise it could damage your participant's auditory canal).

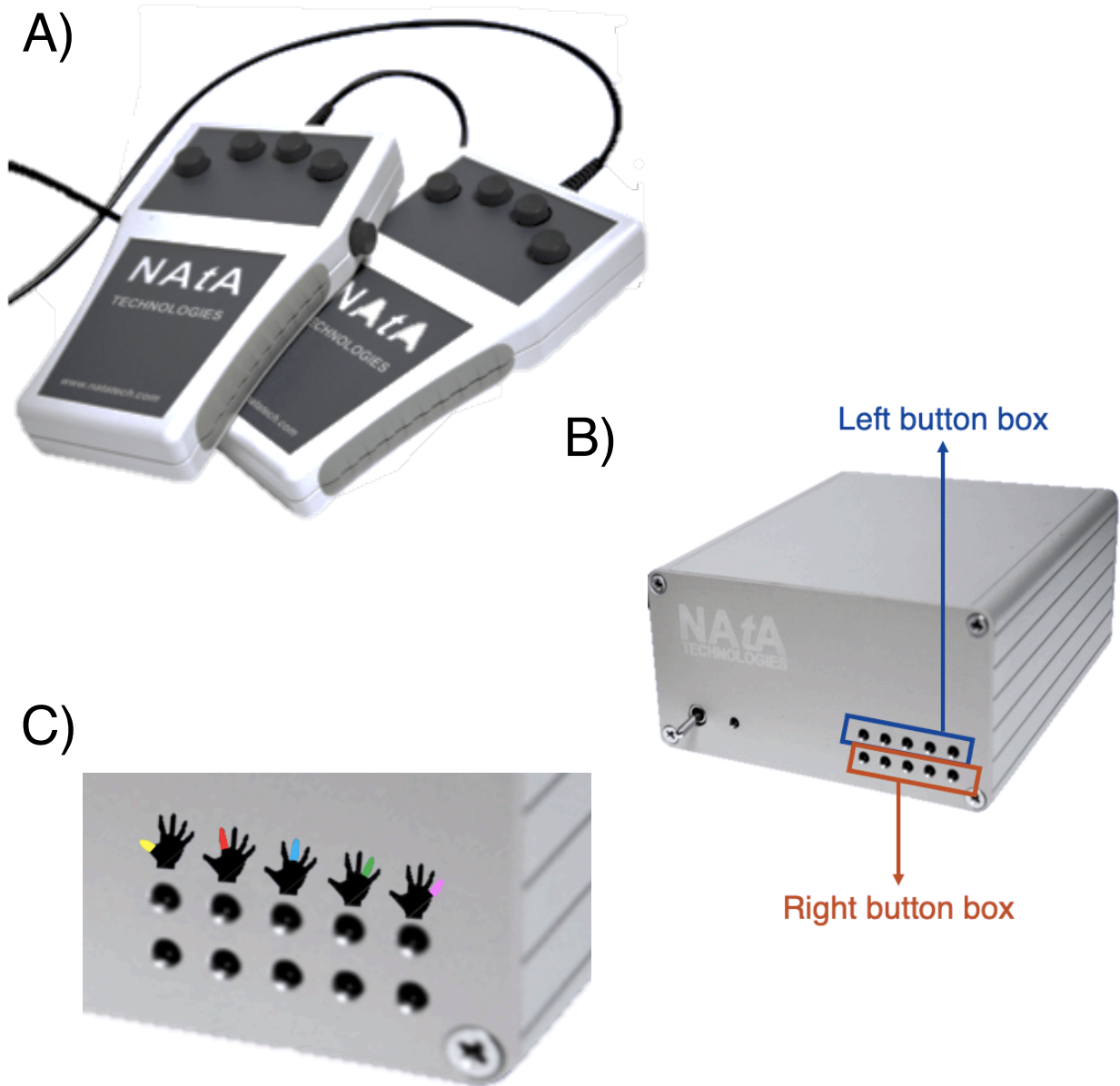
# ***Section C***

## ***Response methods and scanner trigger***





# Response boxes



**A)** Response boxes. **B)** Response box led display. **C)** Close up of the led on the response box led display. For each hand, button presses will appear on the response led display in correspondence of the finger pressed. The order of the fingers (from left to right) is: Thumb, Index, middle finger, ring finger and little finger



## Set up procedures



To activate the response boxes, follow these steps:

1. Locate the Response box led display within the console room cabinet. It can easily be found on the left-hand side of the bottom shelf of the cabinet.
2. Turn **UP** the knob on the Response box led display to activate the response boxes (and do not forget to turn it back down after usage)
3. Plug the USB cable of the Response box led display into your presentation computer (either testing laptop or Cogent PC). Please note that response boxes do not require any software/plugin to work with your laptop. They are automatically recognised as external keyboards.

The buttons on the response boxes correspond to the number keys on the keyboard. You can simulate button presses using your own computer keyboard.



<b>key</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>
<b>hand</b>	Left	Left	Left	Left	Left	Right	Right	Right	Right	right
<b>finger</b>	Little	Ring	Middle	Index	Thumb	Thumb	Index	Middle	Ring	Little

Please note that Psychtoolbox will read these keys as keyboard inputs and it expects the corresponding key labels which include the numbers as well as the symbols: '1!', '2@', '3£', '4\$', '5%', '6^', '7&', '8\*', '9(', '0'

Example:

```
KbName('UnifyKeyNames');
% Define accepted keys
responseKey = KbName('7£');
```



## *Troubleshooting*



Before starting your data collection, test that the responses are registered correctly in your script:

1. Plug the USB cable into laptop or Cogent pc
2. Check that the signal is coming through:
  - ***Check response box display***  
Do you see a red led signal in correspondence of the button that has been pressed?  
If no lights show up and you are positive that buttons are being pressed, please contact a member of BUCNI's staff.
  - ***Check that the signal reaches your device*** (e.g., using a text editor)  
Can you the key strokes in your device? Are they what you expect them to be?  
If no input is displayed, make sure the USB cables are connected to the appropriate device, try a different USB port, try a different device. If no luck or if the input is different from what you expect given the description above, please contact a member of BUCNI's staff
  - ***Check that the signal is registered and saved by your experiment***  
Does your experiment run correctly? Are the responses saved correctly?  
If the signal reaches your device but it is not detected by your script, please check your script.

The response boxes have been tested with Matlab and Psychtoolbox (various versions), PsychoPy, Unity and Cogent (although we discourage further usage of Cogent as it is not further supported). If you use Psychtoolbox, you can use standard Psychtoolbox demos or some of our BUCNI demos to help you with debugging.



## Demo code – Psychtoolbox



```

%% Psychtoolbox demo - trigger and key presses (D. Bono, 21-04-2021)

% - This is a short demo which could help you when running an experiment at
%   BUCNI using psychtoolbox.
% - This task starts when the trigger signal is detected (lower case t).
% - The task consists of 10 trials. In each trial a number is presented at
%   the center of the screen and participants need to press the equivalent
%   key press.
% - This is the list of expected ASCII codes for key presses and trigger
%   (lower case t)
%   when using psychtoolbox dedicated functions:
%   %%% LEFT BUTTON BOX %%%
%       Pinky: '0)'
%       Ring: '1!'
%       Middle: '2@'
%       Index: '3~f'
%       Thumb: '4$'
%   %%% RIGHT BUTTON BOX %%%
%       Thumb: '5%'
%       Index: '6^'
%       Middle: '7&'
%       Ring: '8*'
%       Pinky: '9('
% - Button presses are detected and stored for each trial

%% Clear workspace and close any previously opened screen
clearvars;
sca;
clear screen;
clc

%Configure random number generator
rng('shuffle');

% Check if Psychtoolbox is properly installed:
AssertOpenGL;
Screen('Preference', 'SkipSyncTests', 0); %Skip default controls
%c3setenv('PSYCH_ALLOW_DANGEROUS', '1'); %Allow connection to Kernel
>windowrect = get(0,'MonitorPositions'); %To get info regarding the size of
your screen
>windowrect = windowrect(1,:); %Ignore any possible second
monitor
>windowrect = [ 100 100 1000 600 ];
>windowrect = max(Screen('Screens')); %Select screen for display of
movie:

%% Show instructions on screen
% Open 'windowrect' sized window on screen, with black [0] background color:
win = Screen('OpenWindow', screenid, 0, windowrect);
Screen('TextFont',win, 'Courier'); %Set Font Type
Screen('TextSize',win, 60); %Set Font Size

```

```

Screen('TextStyle', win, 255 ); %Set Font Colour
DrawFormattedText(win, 'Press any ket to start', 'center', 'center', [255 255
255]);
Screen('Flip', win);
KbName('UnifyKeyNames'); % Switch internal key coding scheme from the
operating system specific scheme to the MacOS-X naming scheme, thus allowing
all operating systems to use one common naming scheme. This increases
portability of your script.
pause (1);
devs = PsychHID('Devices')
numberOfDevices = PsychHID('NumDevices')
[keyIsDown, secs, keyCode]= PsychHID('KbCheck', -8);
%[keyIsDown, secs, keyCode] = KbCheck([-3]);
KbWait; %Wait for trigger to start the task

%% Prepare and start the task

%Prepare stimuli
Stimuli = 0:1:9;
Random_order_stimuli = randperm(length(Stimuli));
%Predispose structure in which data on button presses will be stored
Responses = struct('Trial_specific_kbcode', [], 'Trial_specific_kbnumber',
[]); % Create Response structure variable

%Show stimuli on screen
for trial = 1:10
    pause(0.5)
    % Show stimulus on screen
    Screen('Flip', win);
    Screen('TextFont', win, 'Courier'); %Set Font Type
    Screen('TextSize', win, 80); %Set Font Size
    Screen('TextStyle', win, 255 ); %Set Font Colour
    DrawFormattedText(win,
num2str(Stimuli(Random_order_stimuli(trial))), 'center', 'center', [255 255
255]);
    Screen('Flip', win);

    % Check whether a button has been pressed and ignore trigger signal
    ButtonPressDetected = 0; % This variable assumes a value of 0 when no
button presses are detected and 1 when button presses (but not the trigger)
are detected
    % Wait for button presses to be detected in response to stimulus presented
on the screen
    while ButtonPressDetected == 0
        KbWait;
        %devs = PsychHID('Devices')
        %[keyIsDown, secs, keyCode]= PsychHID('KbCheck', -1);
        [keyIsDown, secs, keyCode] = KbCheck(-1); % Wait for and check
which key was pressed
        responseKey = KbName(keyCode); %This is the ASCII code associated
to each button press --> e.g. key 8 = '8*'
        responseNumber = KbName(responseKey); %This is the button number
associate to each key press in ASCII code --> e.g. key 8 = 37
        % Consider trigger signal as no valid button press
        if responseKey == 't' %That means that the trigger signal has been
detected
            ButtonPressDetected = 0;

```

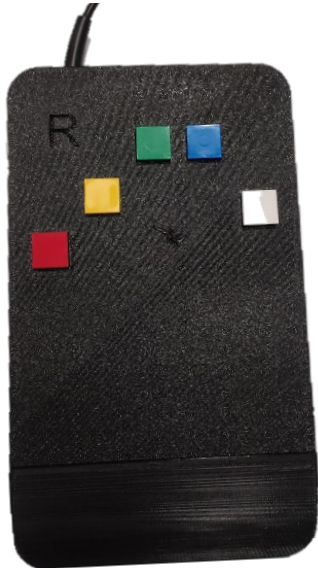
```
elseif keyIsDown == 0 %That means that no button has been pressed
    ButtonPressDetected = 0;
else
    ButtonPressDetected = 1;
end
end
Screen('Flip',win); %Refresh sreen for following trial

% Save response structure
Responses = struct('Trial_specific_kbcode',
[Responses.Trial_specific_kbcode; responseKey], 'Trial_specific_kbnumber',
[Responses.Trial_specific_kbnumber; responseNumber]); % Create Response
structure variable

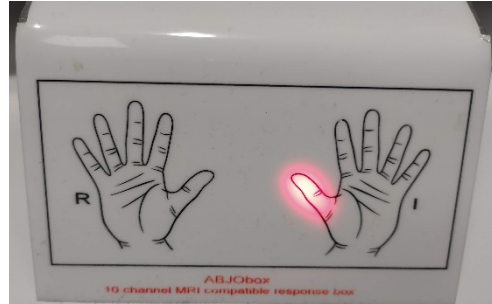
end

sca; % close all screens and Psychtoolbox at the end of the experiment
```

# ***3D printed response box Right only***



*3D right response box*



*Response box display. Button presses will appear on the response led display in correspondence of the finger pressed. Please note that as no 3D left response button box is present, the led display will show an error message and the left thumb led will be continuously on.*



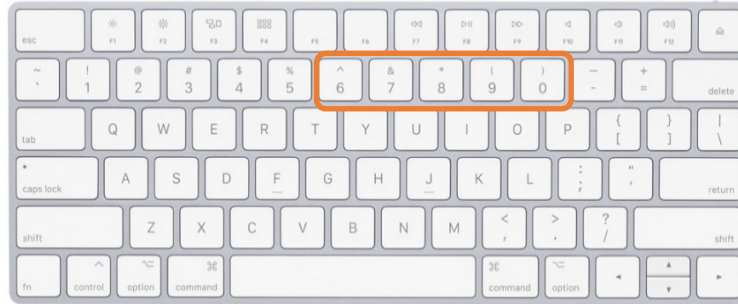
## ***Set up procedures***



To activate the response boxes, follow these steps:

1. Locate the Response box led display underneath the console computer.
2. Plug the USB cable of the Response box led display (it has a distinctive grey metallic colour and a label which reads “button box”) into your presentation computer (either testing laptop or Cogent PC). Please note that response boxes do not require any software/plugin to work with your laptop. They are automatically recognised as external keyboards.

The buttons on the 3D response box correspond to the number keys on the keyboard. You can simulate button presses using your own computer keyboard.



<b>key</b>	<b>6</b>	<b>7</b>	<b>8</b>	<b>9</b>	<b>0</b>
<b>hand</b>	Right	Right	Right	Right	right
<b>finger</b>	Thumb	Index	Middle	Ring	Little

As for the standard response boxes, Psychtoolbox will read these keys as keyboard inputs and it expects the corresponding key labels which include the numbers as well as the symbols:

'1!', '2@', '3£', '4\$', '5%', '6^', '7&', '8\*', '9(', '0'

e.g.

```
KbName('UnifyKeyNames');
% Define accepted keys
responseKey = KbName('7£');
```

## Warning!

Please make sure you are extra careful with your testing if you are using other non-tested software and ask BUCNI staff for recommendations.



# Trigger

The trigger input is sent to your presentation computer (either your testing laptop or Cogent PC) via blue USB cable labelled 'SEQ. TRIGGER'.

***The trigger corresponds to the letter 't' on the keyboard.***

You can simulate the trigger using your own computer keyboard.



## ***Troubleshooting***



Before starting your data collection, test that the trigger is detected correctly in your script:

1. Plug the USB cable into laptop or Cogent pc
2. Check that the signal is coming through:
  - ***Check that the signal reaches your device (e.g., using a text editor)***  
Can you see the 't' appearing on your device every time the scanner sends a trigger? If no input is displayed, make sure the USB cables are connected to the appropriate device, try a different USB port, try a different device. If no luck or if the input is different from what you expect, please contact BUCNI staff.
  - ***Check that the trigger is detected by your experiment***  
Does your experiment run correctly? Is the timing correct? If the signal reaches your device but it is not detected by your script, please check your script.  
The trigger has been tested with Matlab and Psychtoolbox (various versions), PsychoPy, Unity, Presentation and Cogent (although we discourage the use of Cogent as it is not further supported). Please make sure you are extra careful with your testing if you are using other non-tested software and ask BUCNI staff for recommendations.