

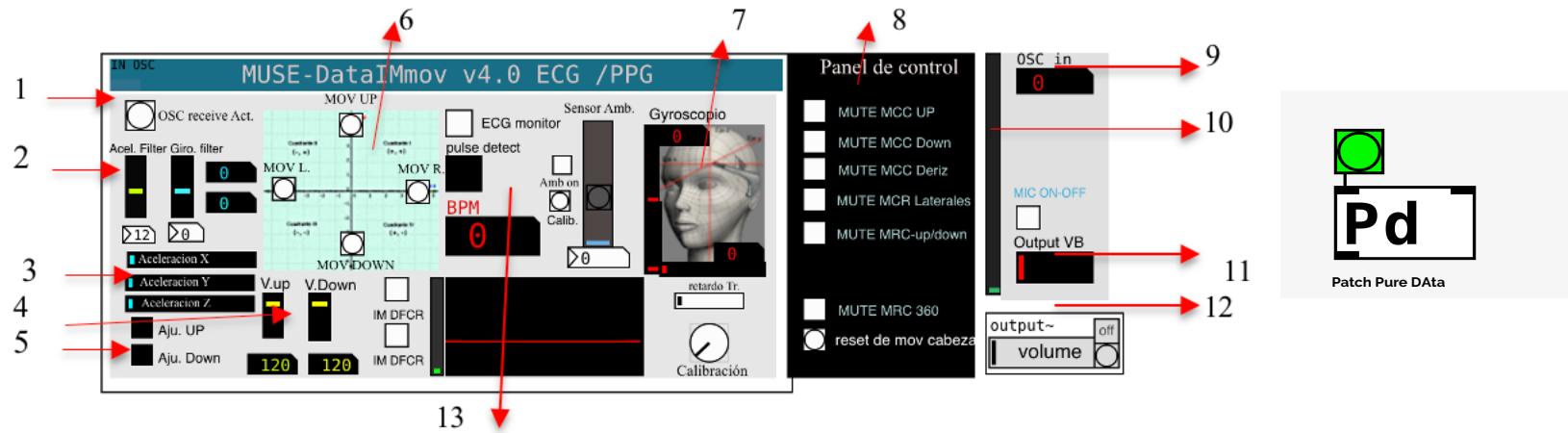
Patch Pure DAta

## MUSE-DATAIMMOV V4.0 MODULE

Diseño y desarrollo de sistemas MMHCI híbridos con bioseñales y un DMI de smartphones, para obras bio-interactivas mixtas y performáticas



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Motion recognition with Muse is intrinsically integrated into head movement. This is based on the position and acceleration measurements captured by the accelerometer and gyroscope integrated in the device. The algorithms are designed to identify four discrete and four continuous states that correspond to possible tilts of the head in different directions. To achieve this, the algorithm must estimate when the head is tilted in one of the four predetermined directions, using only the data from the two-axis accelerometer: x and y

Detection thresholds are configured to act as binary gates, aligned with the acceleration values corresponding to each movement.

Here's a general guide to module functions and connections in PD:

1. **OSC receiver:** This viewer allows you to view OSC data activity.
2. **Accel and Giro filter:** These sliders regulate the parameters of the moving average filter applied to the signals of the accelerometer and gyroscope of the MUSE module, used. Adjusting the filter window allows you to:
  - Low values: They maintain the original signal including noise components.

- High values: Reduce noise but increase system latency. The balance between signal stability and response time must be optimized according to the requirements of each construction site

3. **Accel and Giro Data:** This display graphically represents the values of the accelerometer and gyroscope sensors in the three axes (x, y, z), with the following characteristics:

- Measuring range:  $\pm 9.81 \text{ m/s}^2$  (standard gravitational acceleration).
- Center point: Indicates zero acceleration.
- Extremes: They show positive (top) and negative (bottom) acceleration.

4. **V.up and V down threshold:** A parameter that controls the detection threshold for upward movements in MRCs, with the following specifications:

- Default: 120.
- Adjustable range: 70-120.
- Values close to 70 increase the sensitivity of the system.

The V down slider is opposed to the previous threshold for downward movements with the same range (70-120) and default value (120). Reducing the value improves detection sensitivity.

5. **Up/Down Adjustment:** Button that initiates the calibration protocol for the MCC Y-axis. During the process, an auditory guide indicates the steps required for optimal system adjustment.

6. **IM MRC plane (x,y):** A 2D Cartesian visualization that maps MRC interactions, where each quadrant corresponds to a direction of movement.

7. **MCC Visualizer:** Two-dimensional representation (x, y axes) of the cephalic position, with the following characteristics:

- Central point: Neutral position.
- Extreme: Indicate positive/negative displacements.

- Graduated markers: Facilitate precise adjustment of ranges of motion
8. Control panel. This section enables or disables MIDI data pass-through for interaction.
  9. This number displays a test data to verify that the module is receiving data by OSC from another computer.
  10. Microphone input gain for interaction with audio signals.
  11. Output VB: selector to activate the audio output through the virtual Vb cable port from PD.
  12. General gain and activation of DSP processes in PD.
  13. PPG Sensor Section: This area of the module corresponds to the PPG sensor and fNIRS control interface. This section will be addressed in detail in Chapter 7.

The module is connected as follows:

**Outlet 1-4:** output of y-axis (positive/negative) and horizontal x-axis (positive/negative) MCC IM values in MIDI values. Each output provides values in a range of 0 to 127 for each of the 4 sections of the head movement axes.

**Outlet 5-8:** Output of MRC IM values from the axis (x, y) in MIDI values. Each output provides values in a range of 0 to 127 for each of the 4 sections of the head movement axes.

**Outlet 9-12;** x-axis, y-axis MRC binary output. Provide a (0) or (1) for MRC detection

**Outlet 13:** Flashing IM binary output, provide a (0) or (1) for IM detection

**Outlet14:** Provides ambient light values in MIDI values from 0 to 127 received by the muse 2 PPG sensor