



TECHNICAL SPECIFICATIONS, VALIDATION, AND RESEARCH USE

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INTRODUCTION TO MUSE

Muse: the brain sensing headband, is an electroencephalography (EEG) technology. EEG is a well-established, non-invasive, harmless method of recording the electrical activity of groups of brain cells. EEG provides robust real-time insight into the brain; and Muse is the most versatile and easy-to-use EEG system available.



MUSE FOR CONSUMERS

Muse is designed as a personal meditation assistant. It can pair with any tablet or smartphone and operate with the Muse application, which trains the user in meditation exercises and records EEG data.

Novice meditators usually struggle with two issues: knowing whether they are “doing it right,” and staying motivated. Muse addresses these issues by providing real-time “state of mind” feedback, and offering an engaging motivational framework.

Muse is a personal meditation assistant that can help take your meditation practice to new heights.

Muse is extremely accessible. It is wireless (Bluetooth), lightweight, flexible, adjustable, and easily worn with less than one minute of set-up.

Muse uses two channels on the left and two on the right, so it is ideal for exploring hemispheric asymmetries.

Muse has micro-USB ports on the back of the ear pods where auxiliary electrodes can be attached. These electrodes can be used to measure EMG, ECG, or EEG on other areas of the head or body.

MUSE FOR SCIENTISTS, CLINICIANS, AND RESEARCHERS

Muse is used in hospitals, clinics, and universities worldwide as a research tool. The research domains extend from cognitive neuroscience, to brain health, psychotherapy, music cognition, and more.

Institutions currently using Muse in research include Harvard, Stanford, MIT, Mayo Clinic, NYU, McMaster University, University of Toronto, University College London, and many others.

The Muse Professionals Program is a platform for clinicians and coaches to use Muse with their clients.

<http://professionals.choosemuse.com>

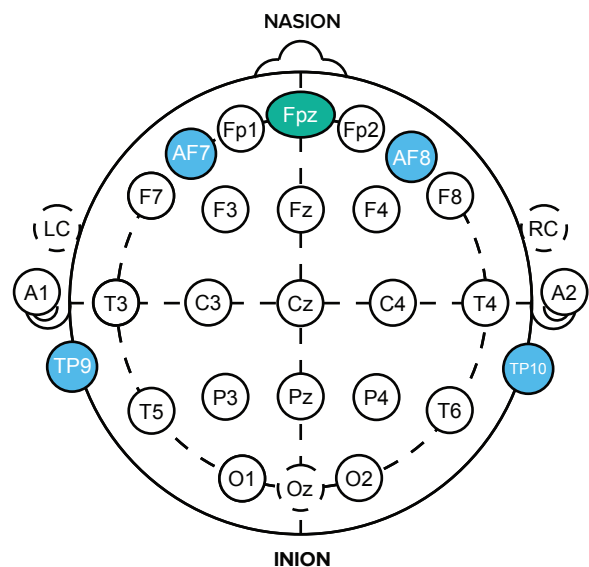
TECHNICAL SPECIFICATIONS

Muse

WIRELESS CONNECTION	Bluetooth 2.1 + EDR	
SAMPLE RATE	220Hz or 500Hz, user selectable	
REFERENCE ELECTRODE	FPz (CMS/DRL)	
CHANNEL ELECTRODES	TP9, AF7, AF8, TP10 (dry)	
BATTERY LIFE	Maximum 5 hours (rechargeable Li -Ion)	
MATERIALS	Silver (frontal electrodes), Conductive silicone -rubber (temporal electrodes)	
WEIGHT	61g	
DIMENSIONS	Minimum head circumference	52cm
	Maximum head circumference	60cm
ACCELEROMETER	Three-axis @ 50Hz, 10 bit resolution, range +/- 2G	
INPUT RANGE	2mV p-p AC coupled signal	
NOISE SUPPRESSION	DRL – REF feedback with 2µV (RMS) noise floor	
	50 or 60Hz notch filter (regional)	
MUSE APP COMPATIBILITY	iOS, Android	
RESEARCH TOOL COMPATIBILITY	Windows, Mac OS, Linux	
LIBMUSE COMPATIBILITY	iOS, Android, Windows	
MICRO-USB PORTS	2	

Muse electrode locations by 10-20 International Standards.

- Reference
- Channel



TECHNICAL SPECIFICATIONS

Muse 2016

WIRELESS CONNECTION	BT 4.0 BTLE	
SAMPLE RATE	256Hz	
REFERENCE ELECTRODE	FPz (CMS/DRL)	
CHANNEL ELECTRODES	TP9, AF7, AF8, TP10 (dry)	
BATTERY LIFE	Maximum 10 hours (rechargeable Li-Ion)	
MATERIALS	Silver (frontal electrodes), Conductive silicone -rubber (temporal electrodes)	
WEIGHT	60g	
DIMENSIONS	Minimum head circumference	52cm
	Maximum head circumference	60cm
ACCELEROMETER	Three-axis @ 52Hz, 16 bit resolution, range +/- 4G	
INPUT RANGE	2mV p-p AC coupled signal	
NOISE SUPPRESSION	DRL – REF feedback with 2 μ V (RMS) noise floor	
	None	
MUSE APP COMPATIBILITY	iOS, Android	
RESEARCH TOOL COMPATIBILITY	None	
LIBMUSE COMPATIBILITY	iOS, Android	
MICRO-USB PORTS	1	



VISUALIZING AND RECORDING EEG

Muse is an open platform: anyone can record raw data with Muse and anyone can build their own Muse application. EEG data can be recorded with MuseLab, MusePlayer, or via the third-party mobile application MuseMonitor (for Android and iOS).

The following tools for researchers and developers are provided in the free SDK (Download the SDK at <http://choosemuse.com/developers>) :

RESEARCH TOOLS

SOFTWARE TOOLS TO RECORD AND ANALYZE MUSE DATA.

MuseIO:

- A desktop driver to stream Muse data over OSC or LSL.

MuseLab:

- Visualize, record, and filter Muse data.

MusePlayer:

- Reroute, replay, and convert Muse data to a variety of formats including MATLAB, .muse, and .csv.

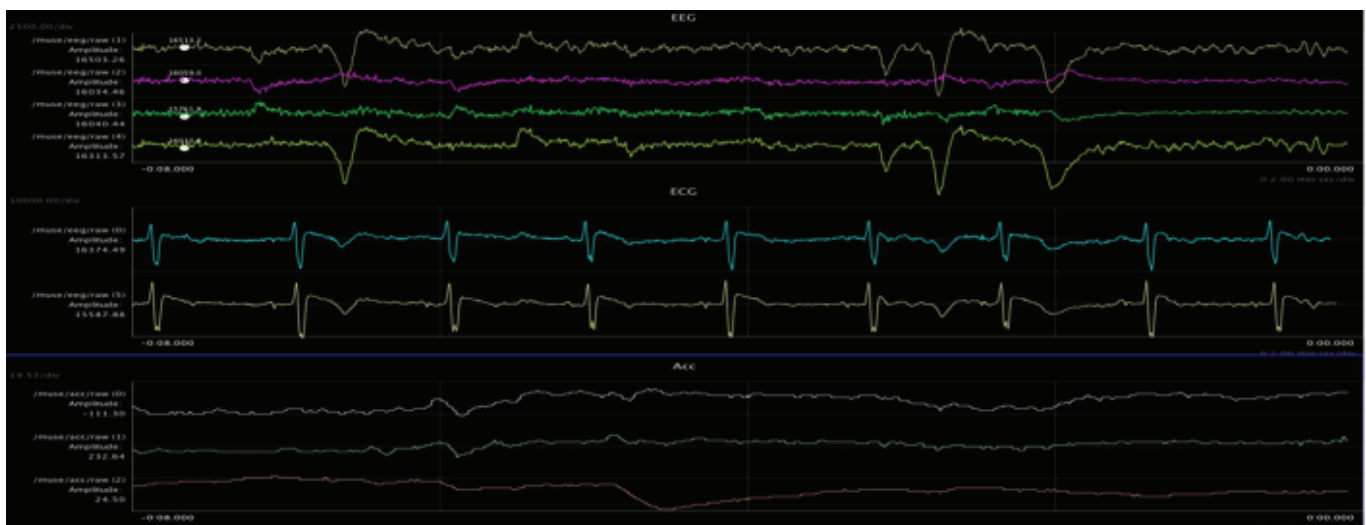
LIBMUSE

A LIBRARY FOR BUILDING NATIVE MUSE APPLICATIONS.

Data includes:

- Absolute and relative power for delta, theta, alpha, beta, and gamma, for each channel.
- FFTs for each channel.
- Proper fit indicator for each channel.
- Blink event.
- Jaw clench event.

Muse's free desktop visualization and recording suite provides rich, raw EEG data, raw accelerometer data, raw spectra (delta (1-4Hz), theta (4-8Hz), alpha (8-13Hz), beta (13-30Hz), gamma (30-44Hz)), total power, artifact detection (eye blink, jaw clench), Fast Fourier Transform (FFT) coefficients, experimental brain-state classifiers, and more.



MuseLab screenshot featuring raw EEG, raw ECG, and raw accelerometer.

For any inquiries into the technical specifications, validation, or applications of Muse, please visit: <http://developer.choosemuse.com>, or contact community@choosemuse.com.