Muse: The Brain Sensing Headband Tech Spec Sheet

Muse Headband:
- Flexible, adjustable, lightweight headband with 7 sensors capable of reading 4 channels of data - two on the forehead and two behind the ears
- Communicates over bluetooth and is compatible with iOS (iPhone 4+, iPad 2+, iTouch 5+), Android 2.3+, Mac OS (OSX 10.8+), Windows 7 & 8 and Ubuntu Linux LTS releases.
- SDK (Software Development Kit) included for the platforms listed above
- Rechargeable battery (charge via micro-USB jack, just like most cell phones). Lasts for 4.5 hours of use.
- The headband produces bipolar readings using AFz as the reference for AF3, AF4, TP9, TP10.
- 3 electrode electrical reference CMS/DRL.
- The 7-sensor montage enables estimation of hemispheric asymmetries (with an emphasis on the pre-frontal lobe) and thus facilitates brain-state discrimination that depends on asymmetry, such as emotional valence (positive vs. negative emotions).
- EEG signals are oversampled and then downsampled to yield a selectable output sampling rate from 220 Hz to 500 Hz, with 2uV (RMS) noise. Active noise suppression is achieved with a DRL - REF feedback configuration using centrally positioned frontal sensors.
- Input range of AC coupled signal (low cutoff at 1 Hz) is 2 mV p-p.
- An on-board 3-axis accelerometer enables motion input for games and for quantifying head movements.

INTERFACE SOFTWARE AND API

In addition to the apps that will be included with Muse, we will supply processing software to use in apps you create yourself. We will provide both higher-level processing (which does sophisticated analysis; details below) and lower-level processing (which simply reads raw data from the device and does some basic analysis) so you can take whichever approach fits your needs.

In developing this system, we opted to offload all real-time analysis to the host system, apart from some basic filtering and compression algorithms. This decision was made in order to conserve battery life on the headband, allow for a sleeker design, and access much more processing power to achieve better brainwave analysis.

Below are a list of features available in the SDKs. We will have SDK at free, developer, and research levels to meet your needs.

- Hardware interface and processing library will be available for iOS, Android, OSX, Linux, Windows.
- API to access:
  - Raw EEG and Accelerometer data

- ○ Processed brain features: including typical EEG power-bands (delta, theta, alpha, beta, gamma), raw power spectrum, and muscle activity.
  - ○ Fully processed data that will yield: beta / alpha ratio (focus vs relax) which will allow developers to develop games around the user's concentration or relaxation. It will also yield measures for eye blinks and jaw clenches.
- Device library interface using OSC messages is also provided to allow easy integration with Max/MSP, Puredata, Quartz composer and Processing.
- Socket API is provided for platforms that support TCP/IP sockets.
- Language compatibility currently includes Objective-C/C/C++, Java, Python.
- Matlab compatible using the socket interface provided by our interface software.