

Supplementary Material S1: Neurofeedback Device and Software

Muse 2 Headband

The Muse device used for measuring brainwaves is a high-performance, compact electroencephalography (EEG) system (Figure S1). By leveraging dry sensor technology, Bluetooth connectivity, improved battery life, and significant advances in digital signal processing, Muse facilitates access to and utilization of brainwave data both inside and outside laboratory settings, including real-world environments. The Muse 2 headband is equipped with four electrodes (TP9, AF7, AF8, TP10), enabling the monitoring of brainwave activity at a sampling rate of 256 Hz and a 12-bit sampling depth.



Figure S1. The Muse device used for measuring brainwaves.

Semse Aware

The Semse Aware application can connect to the Muse 2 headband in order to record and extract brainwave data, including absolute wave values (power spectral density) from the sensors. The variables collected by Semse Aware are listed below:

Variable	Description
Connection	Bluetooth connection quality
Timer	Time counter
Alpha (TP9, AF7, AF8, TP10)	Alpha brainwaves from all four sensors
Beta (TP9, AF7, AF8, TP10)	Beta brainwaves from all four sensors
Delta (TP9, AF7, AF8, TP10)	Delta brainwaves from all four sensors
Theta (TP9, AF7, AF8, TP10)	Theta brainwaves from all four sensors
Gamma (TP9, AF7, AF8, TP10)	Gamma brainwaves from all four sensors
HorseShoe (TP9, AF7, AF8, TP10)	Data quality indicator for all four sensors
ForeheadTouch	Basic data quality indicator: whether the headband is worn on the forehead
SemseAware (Awareness)	Level of 'presence' calculated from Alpha, Beta, Theta, and Gamma values
MasteryThreshold (Baseline)	Threshold value calculated from the 'presence' level
Focus	Level of attention

The Semse Aware application provides objective feedback on users' mental states based on brainwave activity. It is an innovative neurofeedback game that helps individuals learn how to consciously relax, improve concentration, and enhance mental freshness. Figure S2 illustrates how the software displays continuous changes in individual brainwave patterns. Figure S3 presents two example themes (water and forest), which become visually sharper as relaxation-related brainwave patterns strengthen and blur as they weaken.



Figure S2. Visual feedback provided by the software on brainwave patterns.



Figure S3. Two example software themes (left: forest; right: coast).