

Description of Data

Electroencephalography (EEG) measures the electrical activity of the brain, more specifically the voltage fluctuations caused by ionic current flows within the brain's neurons.[1] The electrical activity of the brain has different numbers of waves per second, or frequencies, that are typical of different levels of consciousness. There are established patterns considered to be normal.[2] EEG is usually described as rhythmic activity, which is then divided into different bands by frequency (wavelength). These frequencies have been distinguished from each other because different frequencies have different biological significance. The types of brainwaves, along with their associated frequency range and mental states, are listed below.

Brainwave Type	Frequency range	Mental States and Conditions
Delta	0.1Hz to 3Hz	Deep, dreamless sleep, non-REM sleep, unconscious
Theta	4Hz to 7Hz	Intuitive, creative, recall, fantasy, imaginary, dream
Alpha	8Hz to 12Hz	Relaxed, but not drowsy, tranquil, conscious
Low Beta	12Hz to 15Hz	Formerly SMR, relaxed yet focused, integrated
Midrange Beta	16Hz to 20Hz	Thinking, aware of self & surroundings
High Beta	21Hz to 30Hz	Alertness, agitation
Gamma	30Hz to 100Hz	Motor Functions, higher mental activity

[Source: Brain Wave Signal (EEG) of NeuroSky, Inc.]

Studies have shown that an EEG device can distinguish between voluntary and involuntary attention. A. N. Landau et al. argue that there are increased gamma-band responses for voluntary attention and a lack of gamma-band responses for involuntary attention. This suggests that there are different neural mechanisms controlling these two kinds of attention.[4] If EEG readings can distinguish voluntary attention, then they can also determine a student's level of engagement during class.

How the data will be presented:

The data will be presented to professors via their computer screen in such a way that a mere glance will show them what they need to know to better conduct their classes. Professors will be able to see the overall engagement of the class, as well as individual's engagement. This will be based upon the data regarding EEG readings of student's attention levels. The attention levels of each student will be averaged to determine the engagement of the whole classroom. The screen display will show professors a smiley face for high engagement and a sad face for low engagement. Professors can also click on individual students to view their individual attention level. Students can be viewed either by name or by their position on the classroom map. Professors will also be able to keep track of attendance and how many times each student participates in class discussion. This data will be displayed within each student profile.

References

- Brain Wave Signal (EEG) of NeuroSky, Inc. December 15, 2009. Accessed May 18, 2012. <http://www.neurosky.com/AcademicPapers.aspx>
- “Electroencephalography.” *Wikipedia*. Last updated May 9, 2012. Accessed May 15, 2012. <http://en.wikipedia.org/wiki/Electroencephalography>.
- Landau, Ayelet N., et al. “Different Effects of Voluntary and Involuntary Attention on EEG Activity in the Gamma Band.” *The Journal of Neuroscience*, 31 October 2007, 27(44): <http://www.jneurosci.org/content/27/44/11986.full>.
- Rebolledo-Mendez, Genaro, et al. “Assessing NeuroSky’s Usability to Detect Attention Levels in an Assessment Exercise.” J.A. Jacko (Ed.): *Human-Computer Interaction, Part I, HCI 2009, LNCS 5610*, pp. 149–158, 2009.
- Vorvick, Linda J. “EEG.” *MedLine Plus*. Last updated January 4, 2011. Accessed May 15, 2012. <http://www.nlm.nih.gov/medlineplus/ency/article/003931.htm>.

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- [1] Wikipedia. “Electroencephalography.” Last updated May 9, 2012. Accessed May 15, 2012. <http://en.wikipedia.org/wiki/Electroencephalography>.
- [2] Linda J. Vorvick. “EEG.” *MedLine Plus*. Last updated January 4, 2011. Accessed May 15, 2012. <http://www.nlm.nih.gov/medlineplus/ency/article/003931.htm>.
- [3] Wikipedia. “Electroencephalography.”
- [4] Landau, Ayelet N. et al. “Different Effects of Voluntary and Involuntary Attention on EEG Activity in the Gamma Band.” *The Journal of Neuroscience*, 31 October 2007, 27(44): <http://www.jneurosci.org/content/27/44/11986.full>.