

Figure 2: Facial expression test results.

blinking, looking right, and looking left — were repeated ten times for both the wet and dry electrodes. The wet results (Figure 3) showed three distinct responses based on the action. For blinking, there are significant peaks in each of the electrode channels, while in both directional tests, one half of the brain responded more prominently. When the subject looked right, the right half of the brain showed more significant response, and vice versa for when the subject looked left. When this data was compared to that of the dry electrodes (Figure 4), mixed results were noted. In the case of blinking, the channels behaved relatively similarly in both cases. For the directional tests, however, the dry electrodes did not respond the same way. When looking to the right, some of the channels (AF4, F8, FC6) still performed similarly, while others (F4, T8) were stagnant. Comparable behavior occurred when looking to the left.

From these results, it is evident that dry electrodes have a high potential to replace wet ones, at least in the application of neuroheadsets. They eliminate the need for any electrolytic gel, thereby providing long term measurements.

Future Work:

Despite the promising results, there is still work to be done. The amount of noise recorded in the EEG from the dry electrodes should be addressed, perhaps by designing different dimensions of electrodes based on their location in the headset. This way, increased stability on the scalp may promote less motion artifact. Once this issue is addressed, dry electrodes in EEG headsets can be realized.

Acknowledgements:

The support from the NSF and the NNIN iREU Program, as well as the guidance from Filip

Vanlerberghe, Dr. Hercules Neves and colleagues at imec has made this work possible.

References:

- [1] Webster, J. G., and Clark, J. W. (1992). Medical Instrumentation: Application and Design. Boston, MA: Houghton Mifflin Company.
- [2] EPOC Neuroheadset. (2010). Retrieved 08 02, 2011, from Emotiv: <http://emotiv.com/store/hardware/epoc-bci/epoc-neuroheadset/>
- [3] Voskericiana, G. et al. "Biocompatibility and biofouling of MEMS drug delivery devices." Biomaterials (2003): 1959-1967.

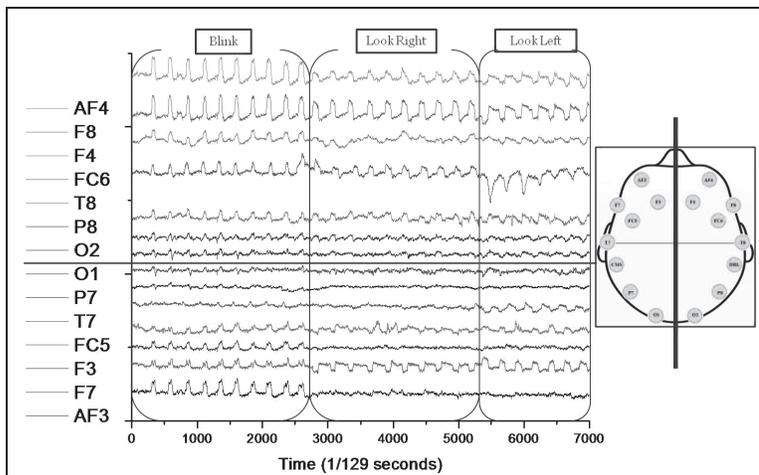
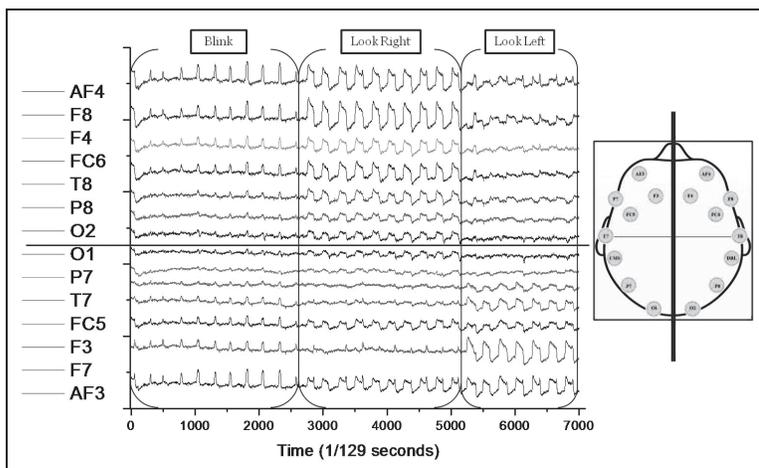


Figure 3, top: Wet electrode EEG results with headset map.
 Figure 4, bottom: Dry electrode EEG results.