The effect of auditory stimulation on human movement variability and associated cortical involvement

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ABSTRACT/INTRO

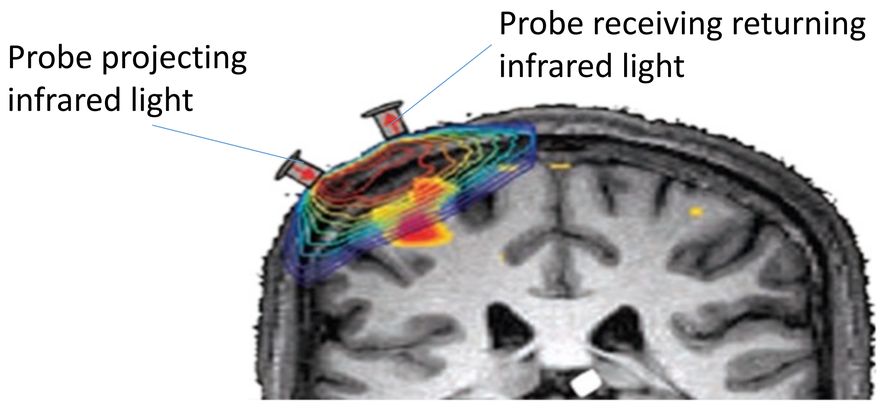
Our goal for this project is to design and test a more versatile cap and sensor mounting system that is also more comfortable. There are two main objectives to this project:

1. Make the device more comfortable to subjects
2. Make the device more versatile

The Biomechanics Research Building (BRB) is presently using functional near-infrared spectroscopy (fNIRS) to measure and understand brain activity during human movement. FNIRS is superior to other devices of its kind because it:

- Allows researchers to attain moving data from subjects.
- Researchers can target specific lobes of the brain to study.
- Various filtering techniques lead to more precise data.

FNIRS attains data by working with pairs of probes. As illustrated in the figure below, one of the probes shoots the infrared light that measures the concentration of oxygen in the blood, then the other probe receives it.



http://www.researchimaging.pitt.edu/sites/default/files/location_images/9b.jpg

METHODS

Our main approach to resolve the problems was to create a new cap entirely. We achieved this by:

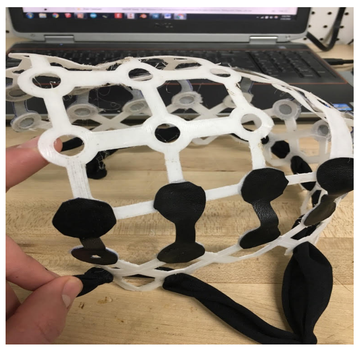
- Raised the probes in order to allow contact only between the spring-loaded portion of the probe and the skull.
- Constructed a cap with a more flexible body.

While this new cap was being produced, a temporary fix involving small quarter inch spacers was used:

No Spacers

With Spacers

New Device
Vs.
Old Device



We experimented with soft plastics such as nylon to introduce advantageous flexibility throughout the cap and achieve objective two, making it more versatile. By keeping the new device flexible, theoretically it had the variability to fit the contours of each subjects skull. A disadvantage of this new design is the possibility of gap junctions between the probes and the skull. These gaps would interfere with data collection.

RESULTS

Collecting data with the newly designed device proved to be inefficient. This is because we were unable to calibrate the FNIRS correctly. The inability to calibrate the machine led to faulty, unusable data.

CONCLUSIONS

<u>Possible reason for failure:</u>

We think that the inability to calibrate is due to the decreased pressure applied to each probe. When the pressure was decreased, the downward force of the probes was also decreased. The decreased force does not establish a close enough connection through hair and scalp debris as the old device did. We believed that the old device that exerted more force and pressure compressed the subjects hair resulting in a higher quality connection.

<u>Future direction:</u>

For the future of the cap, more research is required to understand the geometrical applications applied to the technology. The geometry of the device makes it applicable to different skull shapes, while remaining efficient in data collection. Also, the discomforting pressure exerted by the probes needs to be distributed using a different future method.

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