

9-18-2013

The effectiveness & Operation of NIRS Devices

William Nicks

Follow this and additional works at: https://scholarcommons.usf.edu/npml_events_archive

Scholar Commons Citation

Nicks, William, "The effectiveness & Operation of NIRS Devices" (2013). *Poynter Library Events*. 104.
https://scholarcommons.usf.edu/npml_events_archive/104

This Presentation is brought to you for free and open access by the Library Publicity and Events at Scholar Commons. It has been accepted for inclusion in Poynter Library Events by an authorized administrator of Scholar Commons. For more information, please contact scholarcommons@usf.edu.



THE EFFECTIVENESS & OPERATION OF NIRS DEVICES

William C. Nicks VII & Dr. Christina Salnaitis

Investigators

- P.I. William C. Nicks VII
 - ▣ B.S. Psychology & B.S. Political Science
 - University of South Florida Saint Petersburg
 - ▣ Interests: attention & executive functioning

- Co-P.I. Dr. Christina Salnaitis
 - ▣ Ph.D. Educational Psychology
 - University of Northern Colorado
 - ▣ Interests: anxiety & executive functioning

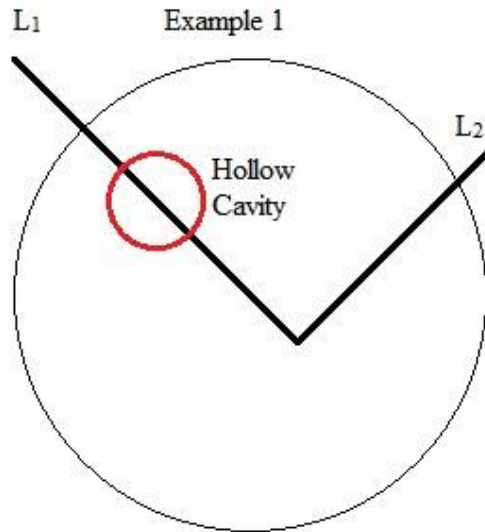
What the heck is a “NIRS Device”?

- Near-infrared spectroscopy (NIRS)
 - Used across multiple disciplines
 - Measures regional changes in hemoglobin
 - Uses light (LED or Laser) to penetrate the skull
 - Non-invasive, portable, cost effective (comparatively)
 - **HIGH** task flexibility
 - **NO** spatial information (we can't see the brain activity)
 - Multiple device types

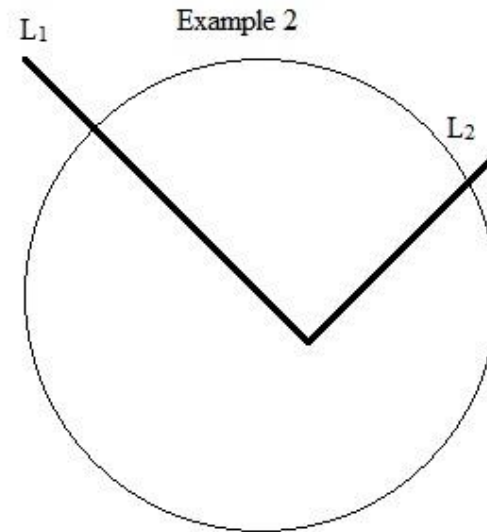
How does this device work?

- Different objects possess different optical properties
- Hemoglobin contains chromophores
 - ▣ Also found in skin & hair
- Intensity of light
 - ▣ Scattering – Constant; estimated for most NIRS devices
 - ▣ Absorbed – Depends on “solution”
- Baseline vs. task measurements
- Measurement depth limited to several MM of cortices

The path of light



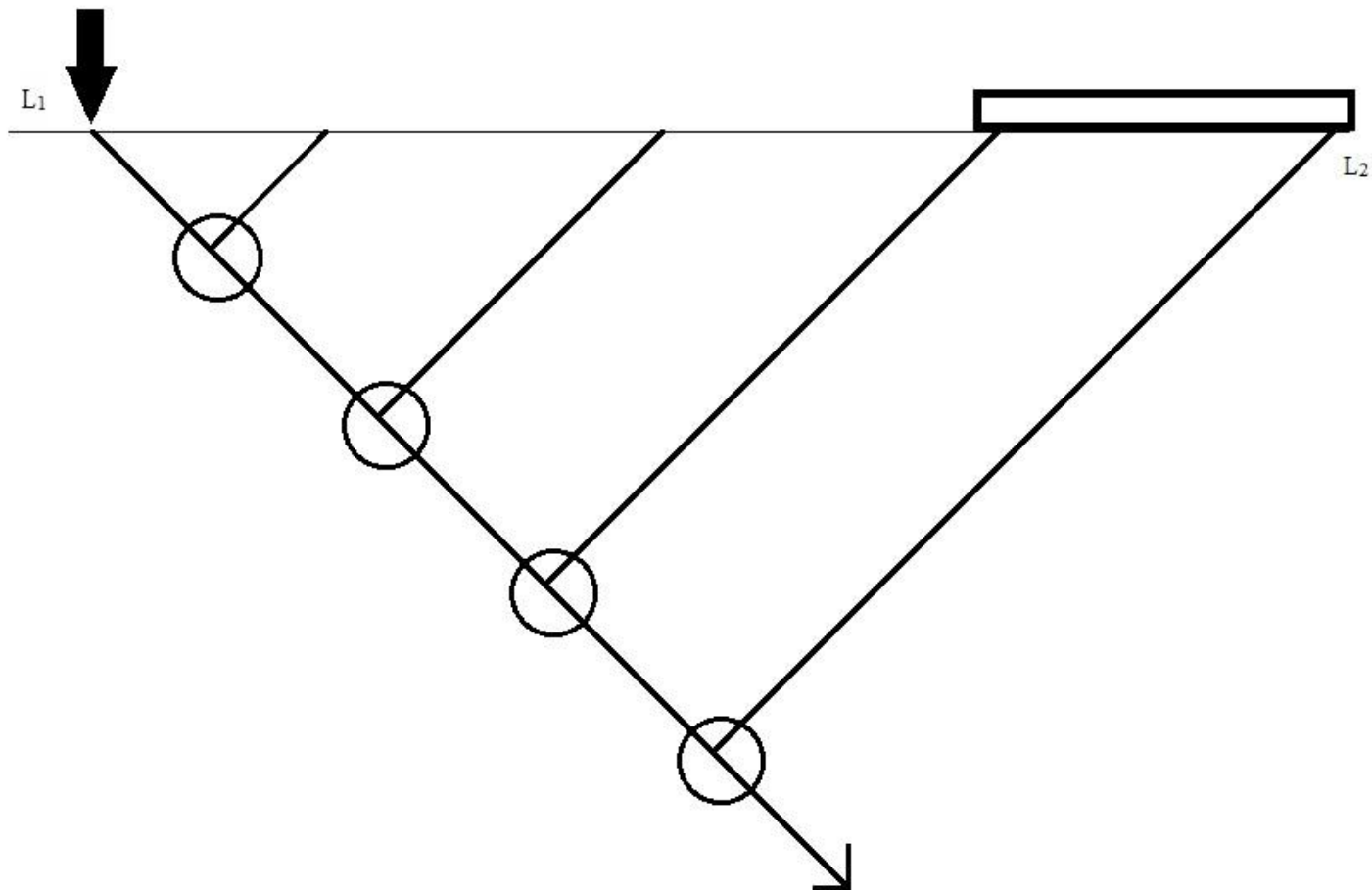
As L_1 passes through a cavity containing no tissue, rate of absorption is significantly decreased. The final signal, at L_2 , has undergone less absorption than light detected in the second example. Photon path length and intensity of light emitted are assumed equal in both examples.



The initial signal at L_1 is assumed to scatter constantly and become absorbed by tissues sensitive to the light's frequency. This principle is known as the Modified Beer-Lambert Law.

Measuring areas of the brain

- “Channels” (path from source to detector)



Error & Issues

- Hair!
- Poor placement
- Standardized methods not established
 - ▣ File formatting
 - ▣ Placement techniques
 - ▣ Measurement/Analysis software

Meta-analytic findings

- 27 studies reviewed
- 96.3% successfully measured ROI
- Studies mentioning placement techniques
 - $d=.316$; successful channel measurements within studies that did vs. did not mention channel placements
- 55.6% of sample reported negative channel data

Conclusions

- NIRS is a valid & reliable technique
- Successfully measures frontal cortex
 - ▣ Other areas discussed within literature
- Publication bias skews our data
- Standardized methods required

Special thanks to:

- Dr. Christina Salnaitis
- USFSP Psychology Department
- Nelson Poynter Memorial Library
- Kaya Van Beynen & Carol Hixson