

fNIRS-based brain-function research

# Measurement of brain function during acting

Measuring the Sense of Self and Interpersonal Coordination in Professional Actors

Data courtesy of University College London

## Key Points

- 1) Measurement using fNIRS suggested that prefrontal cortex response to hearing one's own name was suppressed during acting.
- 2) By measuring multiple modalities simultaneously, it is possible to evaluate whether components in fNIRS data are derived from brain activity.
- 3) LIGHTNIRS™ can measure the brain activity of multiple people simultaneously, even during physical tasks such as acting.

## Measurement & Task

Participants: three pairs (six participants) of professional actors  
 Task: walking (45 seconds), speaking (45 seconds), and acting (120 seconds) for a total of 20 minutes + "name-call" events  
 Measurement: LIGHTNIRS (fNIRS), heart rate (HR), respiration rate, and motion capture.

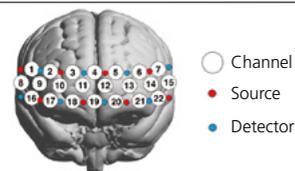


Fig. 1 LIGHTNIRS™ optodes placement and channel configuration

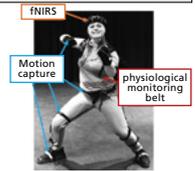


Fig. 2 Subject wearing sensors

## Data Analysis

- LIGHTNIRS data were preprocessed using Homer2<sup>\*1</sup> as follows:
  - Converted fNIRS signal to optical density
  - Corrected motion artifacts and removed high-frequency noise such as heartbeat
  - Converted into concentration changes of  $\Delta\text{HbO}_2$  and  $\Delta\text{HbR}$
- fNIRS signals were then used to run two analyses:
  - (1) Contrast effects analysis using the SPM for fNIRS toolbox and (2) Brain-to-brain coherence analysis using wavelet transforms.

\*1 Homer2: an open-source software package for analyzing fNIRS data

## Data

When actors were not acting (Fig 3B), their mPFC<sup>2</sup> responded to hearing their own names, demonstrating the well-known name-call effect. When they were acting, this effect was not present. Thus, we did not find a significant effect from name-calling while acting (Figure 3A) when actors heard their partner's name with respect to their own name. This result shows the response to self-name was suppressed by acting. To assess inter-individual synchrony, we compared the multiple modalities data of both actors using wavelet coherence analysis and found statistically significant inter-individual synchrony in the frequency band of the task in R-IFG<sup>2</sup> and R-FPC<sup>2</sup>. However, the same frequency range didn't show changes in heart-rate or breathing. This result suggests it is possible that the effects in R-IFG and R-FPC may reflect the coordination of cognitive processes such as mutual prediction. Taken together, by measuring across multiple modalities, it will be possible to disentangle the factors that drive interpersonal coherence.

<sup>2</sup> mPFC: medial prefrontal cortex, R-IFG: right inferior frontal gyrus, R-FPC: right frontopolar cortex

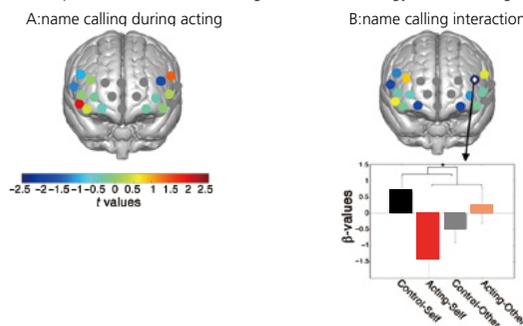


Fig. 3 t value maps for contrasts computed on the actors' fNIRS activation signals

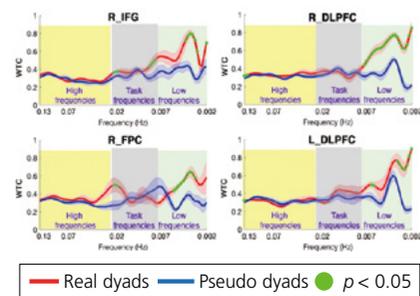


Fig. 4 Group results of real versus pseudo dyads for each brain region (Excerpts)

## The present data was obtained using the following recommended system.

Product Name	Part number (P/N)	Product Image
LIGHTNIRS main unit pack	292-34000-(40/42/46/58)	 LIGHTNIRS 8 input pairs 22 Channels
LIGHTNIRS fiber 2m (8 sets)	567-11350-02	
Holder, Type A	292-34006-41	

LIGHTNIRS



Also consider the below system which has wide-ranging research applicability.

Product Name	Part number (P/N)	Product Image
LABNIRS™ main unit (4 sets)	567-08601-11/12/13 567-10201-14/15/16/17 (RoHS)	 LABNIRS™ 16 input pairs 52 Channels
L-shaped fiber (4 sets)	567-10288-01	
3 modules (+12 sets)	567-10286-13	
L-shaped fiber (+12 sets)	567-10288-13	
Forehead fiber holder (3x9)	594-07600-04	

### Recommended options

3D position measurement system	567-10401-02	
MRI fusion software	567-10391-02	

LABNIRS



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