If the cap fits.... NIRS at CBCD

SARAH LLOYD-FOX
MY BEGINNINGS

CBCD: 2005
Development of headgear at CBCD with UCL
PhD work: Exploring early social brain responses

Social – Non-social paradigm

Visual social activation

(Lloyd-Fox et al., 2009, 2011, 2013, 2014)
NIRS Methodological innovation

Bespoke NIRS headgear
First to expand fNIRS to multi-channel technology for use with mobile, awake infants

International NIRS training
Annual international courses fNIRS Society Communication and Education Committees

Commercialisation of headgear

Optimisation of software
OpenScience
fNIRS-fMRI co-registration
Comparison of software approaches
Cross-disciplinary collaborations

Anna Blasi
**PhD work: Exploring early social brain responses**

Most cited paper:

*Neuroscience & Biobehavioral Reviews*

Review

Illuminating the developing brain: The past, present and future of functional near infrared spectroscopy

**Social – Non-social paradigm**

(Lloyd-Fox et al., 2009, 2011, 2013, 2014)

Visual social activation
Ecologically valid studies: dual fNIRS multiple participants (infants)
Visiting researcher at CEU, Budapest
with G Csibra, Lloyd-Fox

Self awareness, mimicry, connectivity,
PhD by Chiara Bulgarelli
with V Southgate, A Hamilton, C de Klerk, A Blasi

Body perception in infancy
PhD by Maria Laura Fillippetti
with M Johnson, M Longo, S Lloyd-Fox

Expansion of NIRS research at CBCD

Metabolic markers oxCCO
PhD by Maheen Siddiqui
with C Elwell, M Johnson, S Lloyd-Fox

Social and affective touch
PhD by Laura Pirazzoli
with T Gliga, M Johnson, S Lloyd-Fox

Family likelihood studies: ASD and ADHD BASIS and EU-AIMS projects
with A Blasi, E Jones, T Gliga, T Charman, D Murphy, M Johnson, S Lloyd-Fox. JJ Begum
My work focuses on understanding development in the context of early adversity and risk

1) investigate developmental trajectories across infancy
2) understand the impact of early life risk factors of adversity on neurodevelopment
3) Understand adaptive strategies / advantages that some infants have
4) transfer knowledge / expertise to global health / community settings
Background. Child development in low/middle income countries.

Gambian Growth data – Head circumference z-score

Average z-score – global level (WHO)

(Nabwera et al., 2017, Lancet Glob Health)
**Background.** Known risk factors in rural Gambia.

- Stark variation of nutrient availability across course of the year
- Poor quality, frequently contaminated foods
- Undernutrition related to infectious disease
- Rely primarily on subsistence farming
- Majority of population live below poverty line (earn <$2/day)

- Polygamous family structure common: average household N = 17
- Risk factors: Biological, psychosocial, poverty associated

van der Merwe et al., 2013; Lunn et al., 1991; Lunn, 2000
Parental mental health

Family / SES / Sleep

Questionnaires

Biological measures

Growth/Nutrition/Diet

Behavioural measures

Eyetracking

PC

Measuring the brain

Home visits

NBAS

LENA

Caregiving practices

EEG

fNIRS

fNIRS

The Gambia - N = 222

UK - N = 62

prenatal

birth

7-14 days

1 mth

5 mths

8 mths

12 mths

18 mths

24 mths
The BRIGHT Team

Lead Investigators:
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Sophie Moore
Momodou Darboe
Andrew Prentice
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Michelle de Haan

UK
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NIRS & EEG:
Anna Blasi
Laura Kischkel
Eyetracking:
Luke Mason
Behavioural Assessment & Questionnaires:
Bosiljka Milosavejkevic
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Sherrifo Jarjou
Mustafa Joof
Patrick Nshe

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Yusupha Dampha
Mustapha Joof
Babatam Bah
Edrisa Sinjanja

Recruitment/Anthrop:
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Sherrifo Jarju

Visiting/Past students:
Laura Steiner
Jasmine Siew
**fNIRS: Habituation and Novelty Detection**

**Stimulus paradigm**

“Hi baby! How are you? Are you having fun? Thank you for coming to see us today. We’re very happy to see you” “Denano a be nyadii. I be kongtan-rin? Abaraka bake ela naa kanan njibee bee, n kontanta bake le ke jeh”.

- **Trials 1 – 5**: FAM 1
- **Trials 6 – 10**: FAM 2
- **Trials 11 – 15**: FAM 3
- **Trials 16 – 20**: NOVELTY
- **Trials 21 – 25**: POST-TEST

- **FEMALE SPEAKER**
- **MALE**
- **FEMALE**

**8 month olds**
**UK, N = 43**
**The Gambia, N = 99**

*Lloyd-Fox et al., Developmental Science 2019*
1. UK infants show a decline in response across the familiarization trials reflecting habituation to the stimuli.

2. UK infants show a recovery of response to novel stimuli.

3. Gambian infants habituate at a slower rate than UK infants and continue to habituate across the trials containing novel sounds.

**fNIRS: Habituation and Novelty Detection**

8 month olds  UK, N = 43  The Gambia, N = 99

Lloyd-Fox et al., Developmental Science 2019
Decline in performance: Gambian infants’ show a decline in performance with age on the Mullen Scales of Early Learning (MSEL).

Notes:
N (The Gambia) = 5mo: 158, 8mo: 164, 12mo: 160
N (UK) = 5mo: 46, 8mo: 48, 12mo: 41

Bosiljka Milosavljevic
Cognitive and Motor Development

1. At 5m and 8m, over half of the Gambian infants’ MSEL scores were in the “Average” range and a proportion scored “Above Average” or “Very High”.

2. By 12m, a majority of Gambian infants score “Below average” or “Very low”, with only a small proportion being “Average” and no participants scoring above average.

3. In the UK, a majority of infants scores fell in the “Average” range across the three time points, with some variation in proportions falling into the other categories.

Notes:
N (Gambia) = 5m: 158, 8m: 164, 12m: 160
N (UK) = 5m: 46, 8m: 48, 12m: 41
Challenges of understanding impact of multiple poverty associated risk factors (and culturally specific)
Strategies for going global

Local expertise
• Adaptation and feasibility
• On-site piloting
• Analysis approaches

Collaborative science
• Adaptation and feasibility
• Training hubs - networks
• Data analysis approaches

Multi-disciplinary project teams
• Context of risk factors from multiple directions

Data and Task sharing
• Common paradigms across multiple sites
• Open data sharing
• Data sharing Committee

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