

If the cap fits.... NIRS at CBCD



SARAH LLOYD-FOX



BILL & MELINDA
GATES *foundation*

CBCD Anniversary November 15-16th 2019





CBCD: 2005

MY BEGINNINGS



Development of headgear at CBCD with UCL



PhD work: Exploring early social brain responses

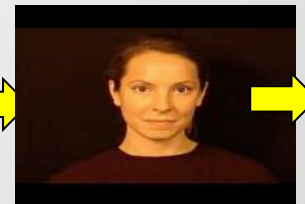
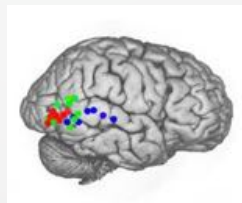
Social – Non-social paradigm



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



Anna Blasi

Commercialisation of headgear

Paris, Budapest, Harvard, Princeton, Seattle, Bangladesh, The Gambia, Nijmegen, Leiden, Copenhagen

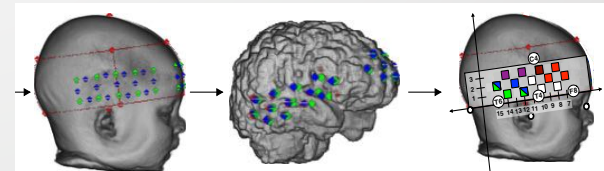
International NIRS training

Annual international courses
fNIRS Society Communication and Education Committees



Optimisation of software

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



PhD work: Exploring early social brain responses

Most cited paper:



Review

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

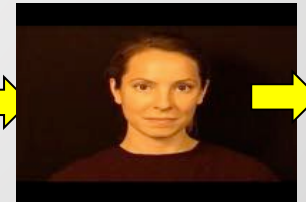
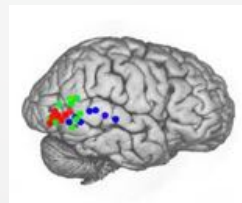
Social – Non-social paradigm



Visual social activation



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



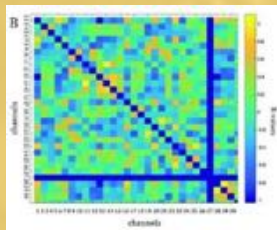
Ecologically valid studies: dual fNIRS multiple participants (infants)

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

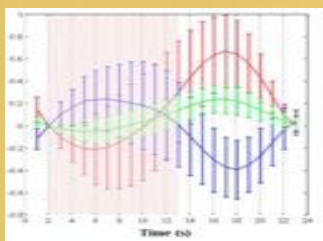
PhD by Maria Laura Fillippetti with M Johnson, M Longo, S Lloyd-Fox



Expansion of NIRS research at CBCD

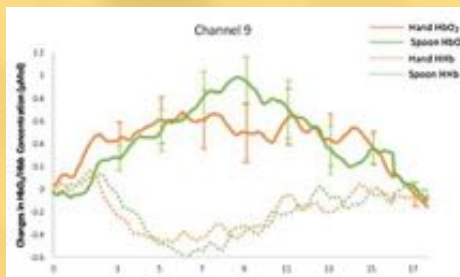
Metabolic markers oxCCO

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



Social and affective touch

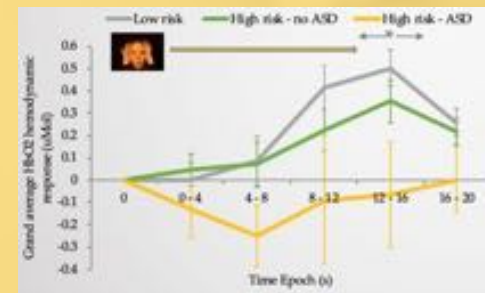
PhD by Laura Pirazzoli with T Gliga, M Johnson, S Lloyd-Fox



Family likelihood studies: ASD and ADHD

BASIS and EU-AIMS projects

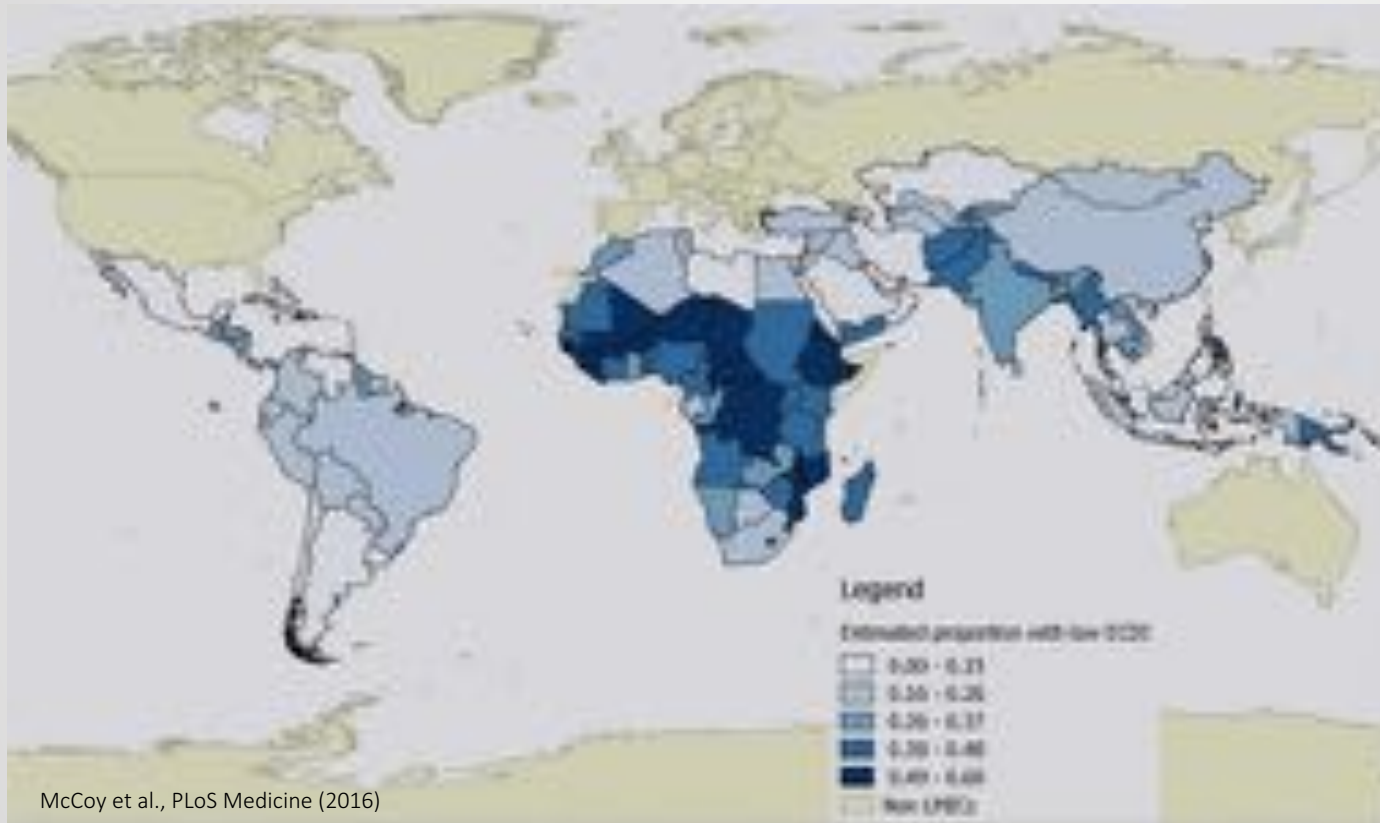
with A Blasi, E Jones, T Gliga, T Charman, D Murphy, M Johnson, S Lloyd-Fox, JJ Begum



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.



1 in 3

1. UNICEF. *Improving child nutrition* (2013);
2. Currie, J. & Almond, D. *Handb. Labor Econ.* 4, 1315 (2011);
3. Victora, C.G. et al. *The lancet* 371, 340 (2008);
4. Hackman, D.A. et al. *Nat. Rev. Neurosci.* 11, 651 (2010);
5. Henrich et al., *Brain Beh Sci* (2013)

Gambian Growth data – Head circumference z-score



Average z-score – global level (WHO)



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



prenatal

birth

7-14 days

1 mth

5 mths

8 mths

12 mths

18 mths

24 mths



The Gambia - N = 222
UK - N = 62

Home visits

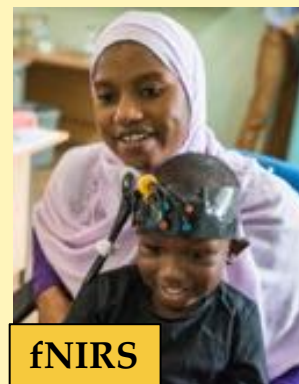


NBAS



LENA

Measuring the brain



fNIRS



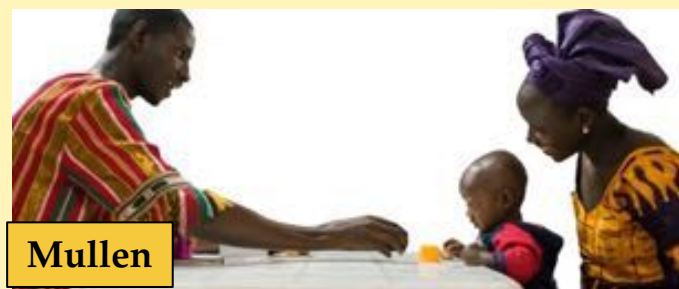
EEG

Behavioural measures

Eyetracking



PC



Mullen

Caregiving practices



Growth/Nutrition/Diet

Questionnaires

Biological measures

Family / SES / Sleep

Parental mental health

The BRIGHT Team



BILL & MELINDA GATES foundation

Lead Investigators:

Clare Elwell	Andrew Prentice
Sarah Lloyd-Fox	Topun Austin
Sophie Moore	Michelle de Haan
Momodou Darboe	

UK

Project Leader:

Maria Rozhko
Marta Perapoch Amado

NIRS & EEG:

Anna Blasi
Laura Kischkel

Eyetracking:

Luke Mason

Behavioural Assessment &

Questionnaires:

Bosiljka Milosavejkevic
Malen Crespo Llado

Current Internships:

Giulia Ghillia

Past

members/students:

Nathan Hayes
Sophie Budge
Dominique Taylor
June Pastor Larietta
Sophie Yelland
Christine Bartram
Isabelle Ormsby
Catherine Southard
Emma Efstatiou

The Gambia

Project Leaders:

Sam McCann
Lena Acoloste

Behavioural Assessment & Questionnaires:

Tijan Fadera
Fabakary Njie
Buba Jobarteh
Kassa Kora
Mariama Saidykhan

Omar Njie

Database:

Ebrima Comma
Abdoulie Faal
Musa Jarjou
Natoma Jarra
Mohammad Ngum

Lab Tech

Sherrifo Jarju

Visiting/Past students:

Laura Steiner
Jasmine Siew

Recruitment/Anthrop:

Ousman Kambi
Ebrima Drammeh

NIRS & EEG:

Ebrima Mbye
Ebou Touray
Muhammed Ceesay
Saikou Drammeh
Mohammed Camara

Clinical team:

Fatou Sosseh
Yusufa Dampha
Fatai Akemokwe
Sherrifo Jarjou
Mustafa Joof
Patrick Nshe

Midwife/Nurse:

Fatou Sosseh
Yusupha Dampha
Mustapha Joof
Babatam Bah
Edrisa Sinjanja

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

Anna Blasi



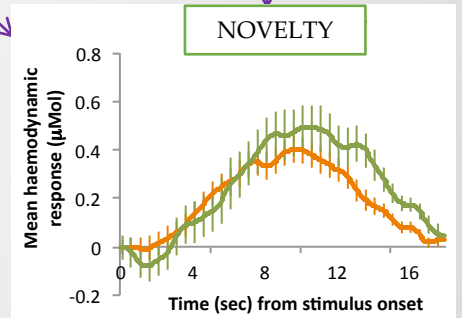
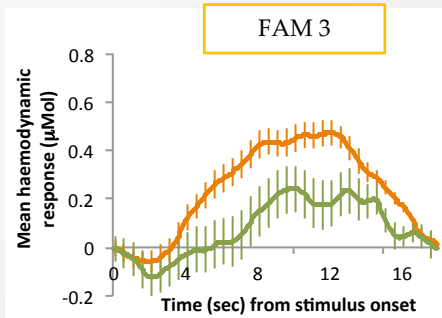
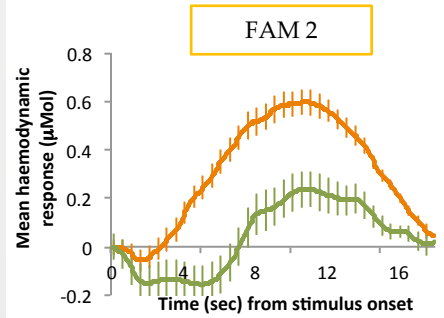
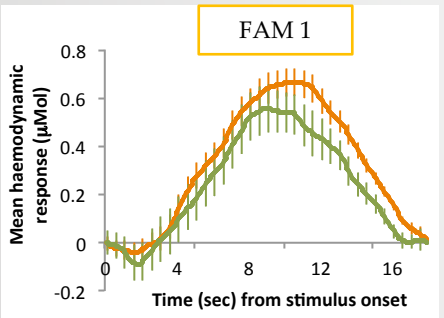
fNIRS: Habituation and Novelty Detection



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.



8 month olds

UK, N = 43

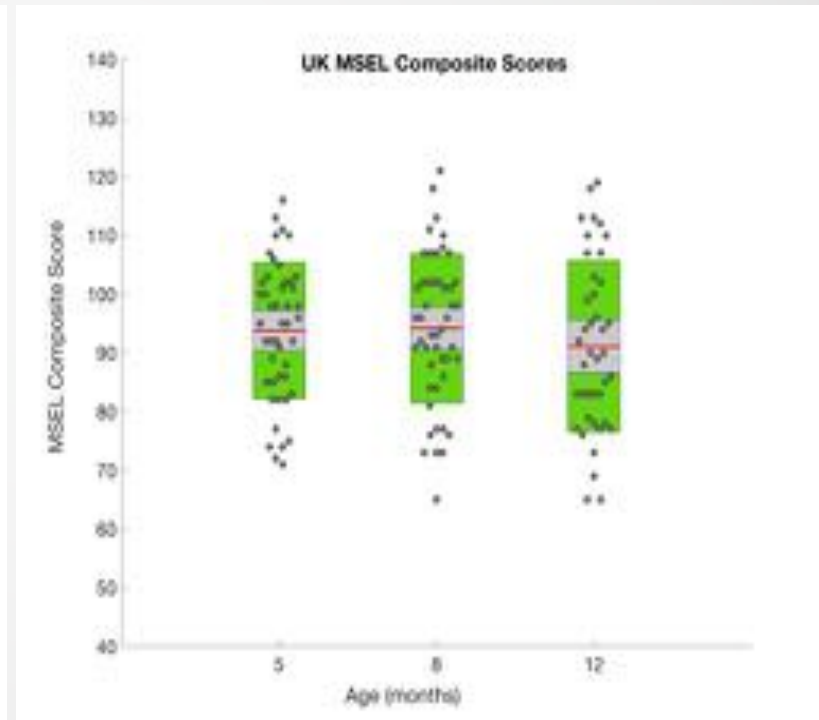
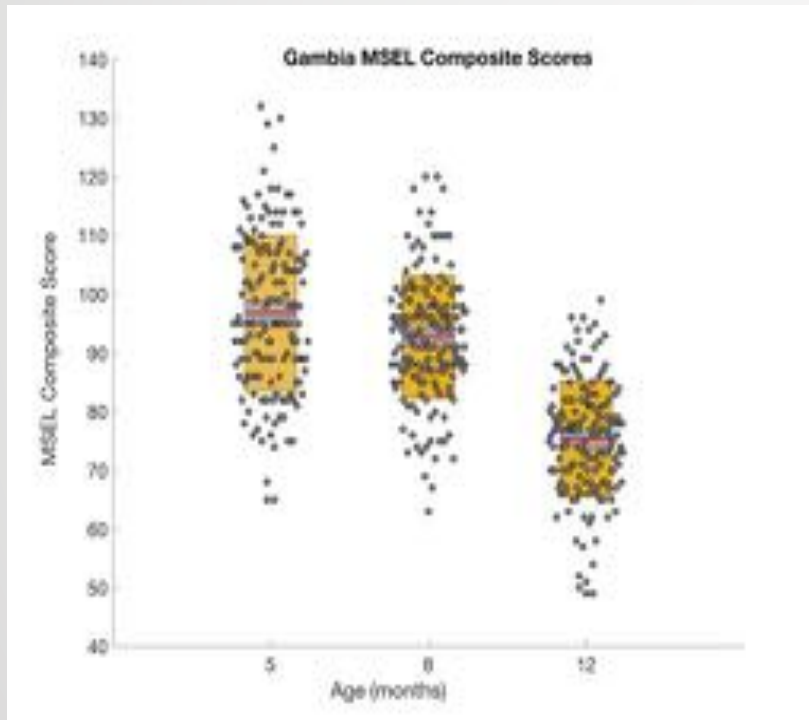
The Gambia, N = 99

Lloyd-Fox et al., *Developmental Science* 2019

Cognitive and Motor Development



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

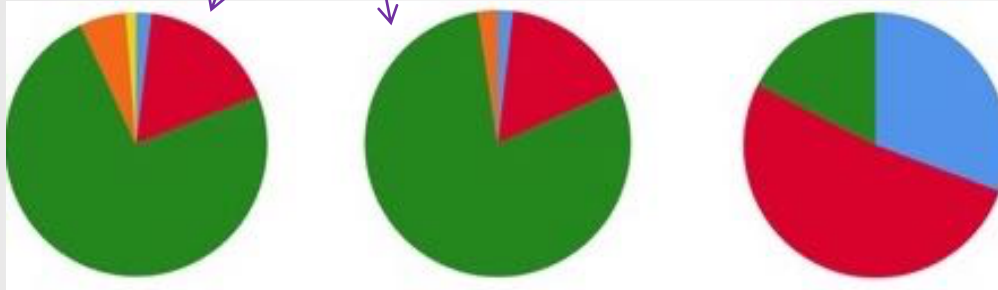


Cognitive and Motor Development

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.

Gambia



UK



Notes:

N (Gambia) = 5m: 158, 8m: 164,

12m: 160

N (UK) = 5m: 46, 8m: 48, 12m: 41

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.

5-months

8-months

12-months



Challenges of understanding impact of multiple poverty associated risk factors

(and culturally specific)



Adverse / Protective / Beneficial



Strategies for going global

Local expertise

- Adaptation and feasibility
- On-site piloting
- Analysis approaches

Collaborative science

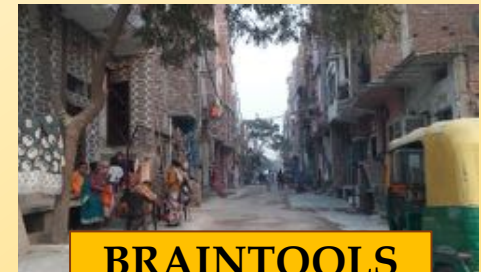
- Adaptation and feasibility
- Training hubs - networks
- Data analysis approaches

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



BRAINTOOLS

Delhi, India



BEAN STUDY

Dakar, Bangladesh

