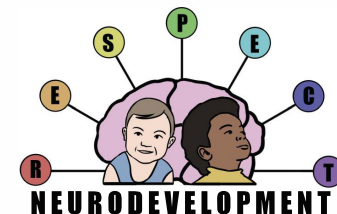


RELIABLE NEUROTECHNOLOGIES

Ilias Tachtsidis and The Reliability
Group

The Challenge



For neurotechnologies to be used in the health care system, in research, for infants, toddlers and preschoolers, reliable data acquisition and analysis is key.

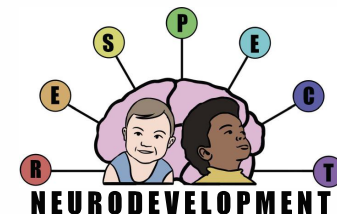
-Data analysis and Modelling [Statistical Frameworks]

-Standardisation [Hardware, Data Acquisition, Software]

Modality Specific Standardization Approaches

Cross-Modality Standardization Approaches

The Challenge



Identify Independent to Modality

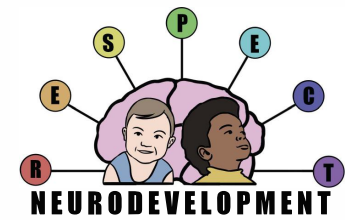
-What are the specific common challenges that neurotechnologies have to overcome within this sensitive population to be reliable.

Identify Modality Dependent

-What we expect specific neuroimaging modalities to demonstrate to be reliable.

**EEG, fNIRS/NIRS, fMRI/MRI,
Challenges to Achieve Reliable
Neuromonitoring/Neuroimaging**

The EEG Group



Lorenzo Fabrizi (co-chair EEG Reliability): l.fabrizi@ucl.ac.uk

Associate Professor

Department of Neuroscience, Physiology and Pharmacology
University College London



Kim Whitehead (co-chair EEG Reliability): kimberley.whitehead@kcl.ac.uk

Senior Lecturer, and Clinical Scientist in Neurophysiology
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Ross E Vanderwert

Senior Lecturer
School of Psychology
Cardiff University



Tracy Warbrick

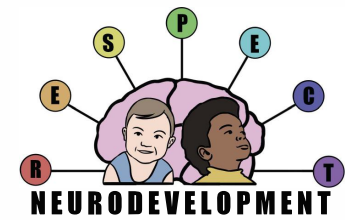
Head of Education and Scientific Communication
Brain Products GmbH
Gilching, Germany



Helene Vitale

PhD student
Unit for Visually Impaired People
Italian Institute of Technology, Italy

The EEG Group



Lorenzo Fabrizi (co-chair EEG Reliability): l.fabrizi@ucl.ac.uk

- Brain development in preterm infants
- Interest in functional analysis of somatosensory and pain processing with EEG, NIRS and fMRI



Kim Whitehead (co-chair EEG Reliability): kimberley.whitehead@kcl.ac.uk

- Clinical and research EEG in health and disease
- Interest in EEG after acquired fetal and neonatal brain injury



Ross E Vanderwert

- How early experiences shape brain development and function
- Interest in how motor systems facilitate social cognition



Tracy Warbrick

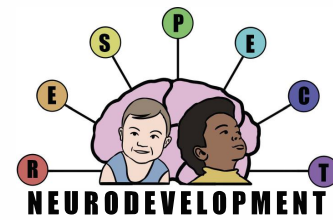
- Industry perspective
- Works with research scientists and clinicians to optimise EEG applications
- Research background in multimodal brain imaging, with specific interest in simultaneous EEG-fMRI



Helene Vitale

- EEG in sighted and blind infants
- Interest in sleep-wake cortical activity and the role of vision in it

The fNIRS/NIRS Group



Dr. Paola Pinti

Birkbeck, University of London, UK
Chair



Dr. Chiara Bulgarelli

Birkbeck, University of London, UK
Co-Chair



Prof. Lauren Emberson

University of British
Columbia, Canada



Dr. Alexander von Lühmann

BIFOLD, TU Berlin, Germany



Dr. Frédéric Lange

University College London, UK



Dr. Sobana Wijekumar

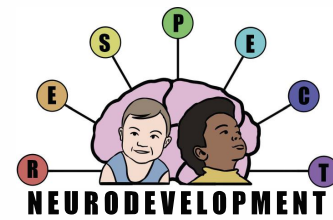
University of Nottingham, UK



Dr. Sarah Lloyd-Fox

University of
Cambridge, UK

The fNIRS/NIRS Group



Dr. Paola Pinti

algorithm development, data analytics,
optimisation for non-conventional lab
settings



Dr. Chiara Bulgarelli

functional connectivity, optimisation for non-
conventional lab settings



Prof. Lauren Emberson

preterm babies and infants,
data analytics and
standardization



**Dr. Alexander von
Lühmann**

hardware development, data
analytics, machine learning,
standardization



Dr. Sarah Lloyd-Fox

optimisation for infants
and low-income settings



Dr. Frédéric Lange

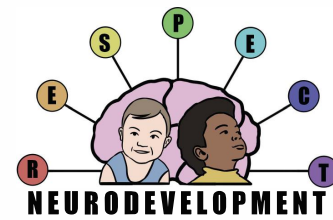
hardware development, clinical application



Dr. Sobana Wijekumar

data analytics and application in rural settings

The fMRI/MRI Group



Jennifer Cooke (King's, co-chair)
Data Acquisition and Analysis
Rare Genetic Syndromes
Lifespan 18 months to 50 years

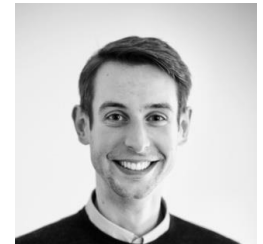


Jonathan O'Muircheartaigh (King's, co-chair)
Data Acquisition and Analysis
Epilepsy, Neurotypical brain development
0-16 years



Francesca Biondo
UCL
Image Analysis & Machine Learning
Neurodevelopment in adversity
0-5 years, 10-16 years

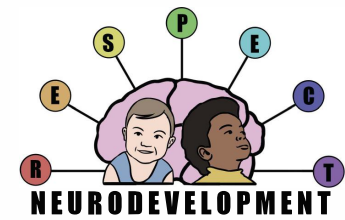
Emil Ljungberg (KCL)
Quality Assurance in MRI
MRI Phantoms, not people!



Ciara Molloy (Trinity College Dublin)
Data Acquisition and Analysis
Rare Genetic Syndromes
Lifespan 18 months to 50 years



What is Reliability



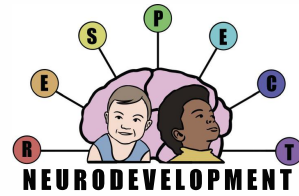
Reproducibility, resilience to external factors, quality maintenance, stability and failure tolerance. With respect to software additionally: data integrity and accuracy, and performance. In the context of science: reproducibility and power.

Reliability can mean two things, the simplest is that the technology works regularly with minimal support (lab tech, debugging software, etc). The second is that when I measure something from one participant, I'm measuring roughly the same thing in another.

Good test-retest, ability to acquire data reliably (hardware), ability for children infants to tolerate scanning.

Application should span across ANY definition of diversity and individual differences, comfortable for participants, less susceptible to breakdown and wear and tear, produce replicable details across projects.

Implementations of Reliability



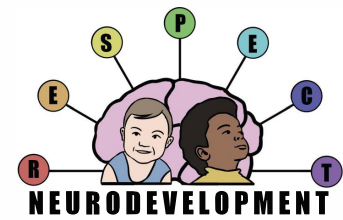
We use the same task at the beginning of every testing session with a participant. Often this data isn't used or is used as a comparison condition (which I guess makes it useful for some aspects of reliability).

Visual inspection of data and results for outliers.

1. checking that resting EEG is appropriate for age (expert report); 2. checking that results are consistent across different population samples; 3. checking that results concur with existing literature; 4. comparing variance during task with variance at baseline.

The Need for Reliability- Standardisation

Network goals



- Create cross-modality groups and build an inclusive multi-disciplinary community through meetings and strategically-targeted working groups towards developing:
 - (1) White paper [work started if you want to participate connect with the relevant reliability group]
 - (2) Contribution to knowledge by identifying common solutions in resolving reliability issues [creation of database with important papers, documentation, processes via website].
 - (3) Create a collaborative network to share and transfer knowledge and support [access to experts via website].



Medical
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Physical Sciences
Research Council

Can you help us?

Help the **Reliability team** to collect information about the reliability procedures you follow in your lab or company. Just answer a few questions by scanning the **QR code** below:



Scan me!

Thank you in advance
for your help!

**Prof. Ilias Tachtsidis
& the Reliability Team**