FUNDING

R4N awards four successful applicants in 2nd round of funding calls

2024-2025

In April 2024, we gave particular priority to applications that demonstrated Ethical and Responsibility concepts. One of the critical pillars of the network is to ensure that neurotechnologies are ethical, desired, acceptable, and user friendly for neurodivergent children and families. Priority was also given to applications that spoke to underserved communities. The following four projects were awarded:

Dr Julia Föcker, University of Lincoln

W.I.S.E. (Wheelchair Integrated Sensory Education)

Dr. Julia Föcker (Grant Awardee)

RESPECT 4 NEURODEVELOPMENT

Our interdisciplinary team includes researchers from Psychology, Computer Science, technicians, as well as teachers working with children with multiple impairments: Polly Atkins (University of Lincoln), Jacqueline Bennison (St Helens Borough Council' Education and Learning. TESSA Vision), Dr Patrick Dickinson (University of Lincoln), Dr Craig Green (University of Lincoln), Emma Hawes (University of Lincoln), Dr Kieran Hicks (Staffordshire University), Prof. Timothy Hodgson (University of Lincoln), Laura Miles (St Francis's school Lincoln), Dr. John Patterson, (St. Vincent's), Dr. Jonathan Waddington (InFocus Exeter; Plymouth Marjon University), and Caitlin Williams (University of Lincoln).

Summary of the project:

This project aims to co-design a multisensory neural technology device in collaboration with children aged 6-12 with varying impairments, including children with severe communication difficulties. Children will interact with our newly developed multisensory device, a six-button box, representing an enlarged braille cell. The device can produce sounds, haptic vibrations, and auditory-haptic vibrations. To interact with the device, users can place their fingertips on the buttons, press them and experience different intensities and patterns of haptic vibrations and sounds. Based on children's preferences, we aim to haptically "enrich" the device, tailor interactions and use neural measurements to record automatic responses such as the so-called somatosensory Mismatch Negativity (MNN). The MMN occurs in the time range of 100-200 ms and allows the detection of rare sensory stimuli from frequent ones. We aim to test the research hypothesis that frequent device interactions in an engaging way might lead to improved sensory experiences and enhanced neural detection mechanisms for sensory patterns in children with multiple impairments.

Borja Blanco, University of Cambridge

The Effect of Early Adversity on Neurodevelopment: Defining a Biological Poverty Line through Social Brain Fingerprinting

Dr. Borja Blanco (Grant Awardee on the left)

The team is also composed of Dr Sarah Lloyd-Fox (University of Cambridge), Professor Mark H. Johnson (University of Cambridge), Maria Rozhko (University of Cambridge) and Anathi Kwinana (University of Cambridge). The project advisors are Professor Topun Austin (Cambridge University Hospitals NHS Foundation Trust), Dr Nicholas Everdell and Dr Samuel Powell (Gowerlabs Ltd, University College London).

Summary of the study:

The first two years of life are a critical period for neurodevelopment, during which early adversity, such as poverty, can profoundly impact cognitive and social-emotional development as well as brain function. While technological advances have improved neuroimaging tools for neurodevelopmental research, most studies remain confined to passive lab-based paradigms that fail to capture the complexity of real-world social interactions. Understanding the neural mechanisms underlying emerging social behaviours requires approaches that reflect infants' dynamic, interactive environments. This project aims to optimize a neurodevelopmental assessment toolkit leveraging

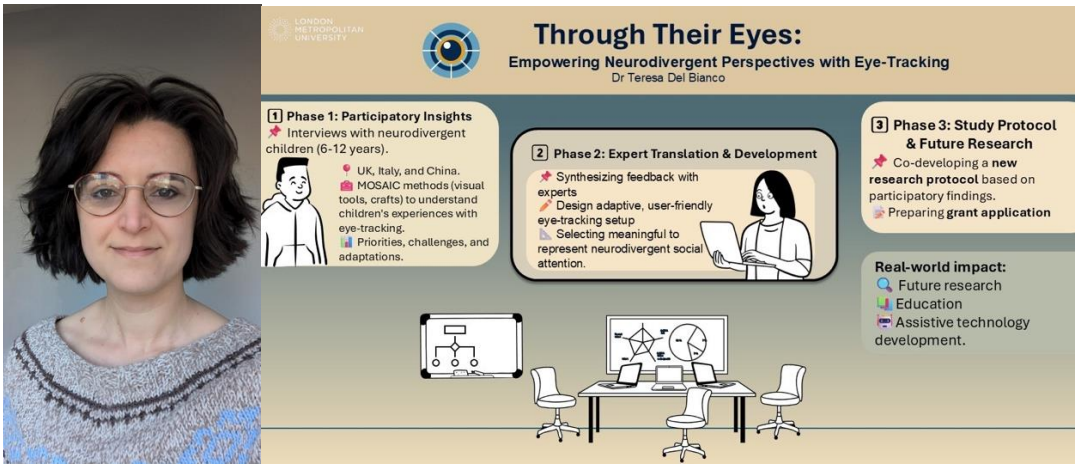
wearable and portable neurotechnologies to study infants' brain activity during social interactions in naturalistic settings, such as their homes.

Specifically, our research seeks to identify brain networks supporting infants' social interactions and examine how contextual factors, such as socioeconomic status, shape developmental trajectories. To achieve this, the project combines the Neonatal Behavioural Assessment Scale (NBAS), a comprehensive tool for evaluating neonatal behaviour and state regulation, with the simultaneous monitoring of brain activity using high-density diffuse optical tomography (HD-DOT). Combining the NBAS and HD-DOT in this way builds on their respective advantages, creating a potentially groundbreaking synergy of methods.

Family feedback and focus groups will guide protocol refinements to enhance child- and family-friendliness, and address barriers to participation, preferences for communication, and privacy concerns. These efforts aim to reduce dropout rates, improve engagement, and ensure inclusivity for families from diverse socioeconomic backgrounds. The project's objectives include demonstrating the feasibility of integrating NBAS and HD-DOT, identifying neuromarkers of social interaction, and advancing accessibility in neurodevelopmental research. By addressing critical gaps in current methodologies, this research aims to provide new insights into early brain development and its modulation by environmental factors, with significant implications for global health and developmental neuroscience.

Dr Teresa Del Bianco, London Metropolitan University

Through Their Eyes: Empowering Neurodivergent Perspectives with Eye-Tracking



Dr. Teresa Del Bianco (Grant Awardee)

The multi-disciplinary team consists of:

Dr. Teresa Del Bianco (London Metropolitan University), Dr. Yanbo Hu (London Metropolitan University), Dr. Georgia Lockwood Estrin (University of East London), Dr. Rianne Haartsen (Birkbeck, University College London), Dr. Rachel O'Connor (St Michael's House), Dr. Juan Kou (Sichuan University), Professor Paola Venuti, Dr. Arianna Bentenuto (University of Trento), Professor Liz Pellicano (University College London).

Summary of the study:

Our project rethinks eye-tracking research by incorporating the perspectives of neurodivergent children and their families. Traditional eye-tracking paradigms often reflect neurotypical assumptions, limiting their ability to authentically capture the experiences of neurodivergent individuals. This study takes a participatory approach, involving autistic children and caregivers in shaping how eye-tracking is used—ensuring that the technology reflects their priorities and ways of engaging with the world.

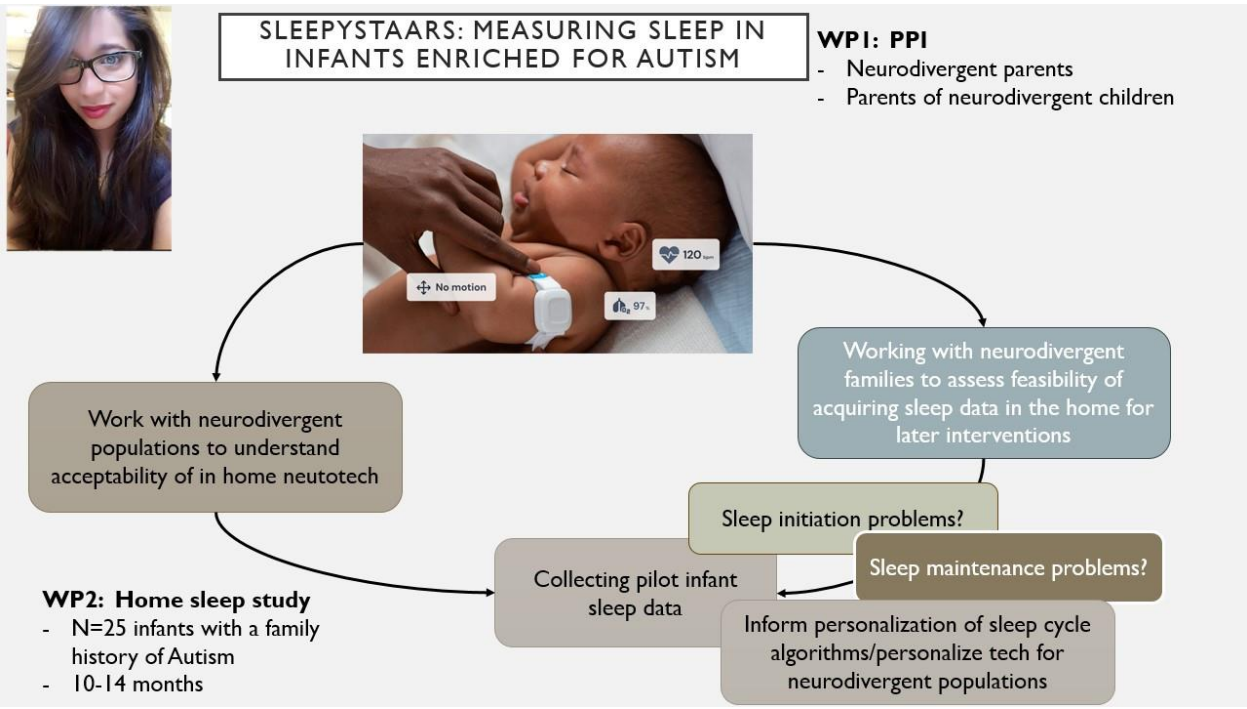
The project combines interviews with parents and interactive eye-tracking exploration sessions with children, using creative tools like drawing and role-playing to understand how children perceive and interact with eye-tracking technology. The findings will inform more inclusive experimental designs, helping to advance research in social attention, learning, and accessibility.

Dr Jannath Begum Ali, Birkbeck, University of London

Sleepystaars: Measuring sleep in infants enriched for autism

The multi-disciplinary team consists of:

Jonathan Baut (Gabi Smart Care Devices), Dr Louisa Gosse (Birkbeck, University of London), Professor Tony Charman (King's College London).



Although, there is increasing evidence of disrupted sleep in infancy relating to later neurodevelopmental symptoms and outcomes, it is important to note that much of this

RESPECT 4 NEURODEVELOPMENT

data is drawn from 'proxies' of sleep (e.g., parent report questionnaires), which can be affected by factors such as socioeconomic status or mental health11. As such, we propose an innovative and multi-method approach to deeply phenotype infants enriched for autism to further examine the association between poor sleep and neurodevelopmental traits. We will objectively measure sleep using concurrent electrocardiogram (ECG) and actigraphy.

Measuring ECG in addition to actigraphy allows us to better determine when participants are truly sleeping as opposed to when they are merely not moving. Whilst we can extract average values for sleep durations and number of night awakenings from questionnaires, actigraphy and ECG data allows us to extract extremely fine-grained detail regarding sleep durations, night awakenings and importantly, the transitions from wakefulness to sleep. Here, we can examine the mechanisms of disrupted sleep that may be specific to infants with a family history of autism (e.g., sleep initiation vs sleep maintenance differences). Further, the state-of-the-art devices are discrete, portable and validated for use with newborns. The scalable nature of the devices mean that we can gather rich sleep data from infants in naturalistic settings over an extended period of time, capturing both daytime naps and nighttime sleep; a feat that would be impossible to do within the lab environment. The aims of the project are:

1) To work with neurodivergent families and industry partners to responsibly assess the acceptability of using neurotechnologies in the home by cocreating/developing the sleep protocol through advisory committees and parent feedback

2) To assess the feasibility of acquiring good quality sleep data remotely within the home setting using this scalable technology to personalise later sleep interventions.