Neuromod+ Final Project Report

Project title:

- Bridging the Gap: Promoting Acceptance and Inclusivity of Non-Invasive Neurotechnology in Ethnic Minority Communities
- Fostering Acceptance and Inclusivity of Non-Invasive Neurotechnology in African Ethnic Minority Communities

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1. Project Summary

This Neuromod+ project addressed a critical and well-recognised gap in neurotechnology research: the persistent underrepresentation of ethnic minority communities, and particularly African diaspora populations, in non-invasive neuromodulation and neuroimaging studies. While neuromodulation technologies such as EEG, fNIRS and non-invasive brain stimulation are increasingly central to neuroscience research and clinical translation, their development and validation have largely excluded communities whose phenotypic, cultural, and social characteristics differ from those of typical laboratory samples.

Through a community-led, participatory approach, this project worked in close partnership with the ISRAAC Somali Community Association in Sheffield to co-design and deliver a programme of workshops, hands-on neurotechnology demonstrations, and community-based EEG and fNIRS data collection. The project moved beyond awareness-raising to directly test whether inclusive, decentralised research approaches can maintain technical rigour while improving trust, acceptability, and willingness to engage.

The work provides one of the first UK demonstrations that community-based neuromodulation and neuroimaging research can be both scientifically viable and socially inclusive, offering a replicable model aligned with the core aims of the Neuromod+ network.

2. Methodology (Brief Overview)

The project adopted a **mixed-methods, community-centred design**, delivered across three interconnected phases:

Community workshops

Three workshops were held within a trusted community setting. These introduced participants to brain research, EEG, fNIRS, and brain stimulation technologies, using live demonstrations, facilitated discussion, and culturally adapted materials. Workshops were gender-matched where appropriate and supported by trained community interpreters.

Community-based neuroimaging sessions

A subset of participants took part in EEG and fNIRS recordings conducted entirely within the community centre. Cognitive tasks were adapted for linguistic accessibility, and participants completed post-session questionnaires and interviews exploring comfort, trust, safety perceptions, and willingness to participate again.

Co-creation and feedback

Findings were fed back to the community in a final reflection workshop, where participants evaluated preliminary results and engaged with an inclusive EEG electrode prototype developed in response to earlier feedback around hair type, comfort, and setup burden.

Qualitative thematic analysis was combined with quantitative benchmarking of EEG and fNIRS signal quality against laboratory data, allowing both experiential and technical outcomes to be evaluated.

3. Key Outcomes and Impact

Advancing Inclusive Neuromodulation

The project identified four major barriers to participation: structural and socioeconomic constraints, cultural and religious requirements, limited awareness and misconceptions about brain research, and trust and accountability gaps. Importantly, these barriers were not abstract; they translated into concrete design requirements for neuromodulation research, including venue choice, staffing models, scheduling, communication style, and hardware design.

By addressing these barriers through co-produced adaptations, the project demonstrated measurable improvements in participant confidence, perceived safety, and willingness to engage in future neuromodulation studies.

Technical Impact

A central concern for inclusive research is whether decentralised, community-based approaches compromise data quality. This project showed that:

- **fNIRS signal quality** collected in a community setting was comparable to laboratory recordings when controlling for known factors such as hair presence.
- **EEG data quality**, while modestly reduced compared to lab recordings, remained analytically usable, with ~70% of epochs retained, demonstrating feasibility rather than exclusion.

These findings directly challenge the assumption that high-quality neuromodulation research must be confined to laboratory environments.

Design and Innovation

Community feedback directly informed the development of an **inclusive EEG electrode prototype**, highlighting how Neuromod+-funded research can influence hardware design practices by embedding inclusivity at an early stage.

4. Contribution to the Aims of the Neuromod+ Network

This project strongly aligns with and advances the Neuromod+ network's goals by:

- **Promoting responsible and inclusive neuromodulation research**, ensuring emerging technologies do not exacerbate existing health inequities.
- **Bridging technical and social dimensions of neuromodulation**, showing that inclusivity and methodological rigour are not competing priorities.
- **Strengthening interdisciplinary collaboration**, integrating engineering, neuroscience, social science, and community expertise.
- **Providing a transferable engagement framework** that can be adopted across Neuromod+ partner institutions and future projects.

The work has already informed subsequent funding, public engagement activities, and policy-relevant discussions around equitable neurotechnology development.

5. Images (Project-Relevant)

Examples of community-based neurotechnology workshops and inclusive engagement activities delivered during the Neuromod+ project can be found here. These illustrate hands-on demonstrations, facilitated discussion, and trusted community-venue delivery.

Additional Project Outcomes / Impacts

Publications

- Mohamed A.A.M. et al., *Fostering Inclusive Participation in Non-Invasive Neurotechnology Research among African Ethnic Minority Communities in the UK*, **under review.**

Collaborations & Partnerships

- ISRAAC Somali Community Association (Sheffield)
- Parkinson's UK
- NIHR Devices for Dignity
- BrainTech Alliance
- London Institute for Healthcare Engineering
- University of Sheffield (Neuroscience Institute, SITraN)

Further Funding

- **£406k ARIA grant awarded**
  Addressing inequity and adoption barriers of neurotechnology among marginalised groups
  Start date: 01/04/2025
  PI: Mahnaz Arvaneh
  Co-Is: Dan Blackburn, Lise Sproson, H. Olya, Oliver Bandmann

Engagement Activities

- Community-led neurotechnology workshops (EEG, fNIRS, and brain stimulation).
- **Project video on equity and diversity in brain research**, developed as part of the Neuromod+ project, which has attracted significant public engagement:
  Equity and Diversity in Brain Research (https://www.youtube.com/watch?v=Mp6FU8QgzK0).
- Public and professional talks:
  - *Inclusive Neurotechnology*, KTN Event on Emerging Technologies for Health and Safety (30 January 2025).
  - *Ensuring Equitable Access to Neurotechnology*, BrainTech Alliance, London Institute for Healthcare Engineering (September 2025).
  - *Emerging Discussions in Brain–Computer Interfaces: Inclusivity and Implicit Communications*, CN3 Summer School (Computational Neuroscience, Neurotechnology and Neuro-inspired AI), University of Ulster, UK (August 2025).

Influence on Policy, Practice, Patients & the Public

- The project and associated video were **featured in the EPSRC Healthcare Technologies Newsletter (October 2025, Issue 18)** as an *exemplary project* demonstrating how to increase diversity and inclusion in brain research (read here: Issue 18, Oct 2025).
- The work was also **featured on the ARIA Precision Neurotechnology website (**https://www.aria.org.uk/opportunity-spaces/scalable-neural-interfaces/precision-neurotechnologies/**)** , highlighting its relevance to equitable and responsible development of neurotechnology.
- The project provides practical, evidence-based guidance for inclusive recruitment, consent, and delivery of neuromodulation and neuroimaging studies, with direct relevance to funders, policymakers, and healthcare researchers.

Research Tools & Methods

- Community-adapted EEG and fNIRS protocols.
- Participatory, community-led engagement framework for neuromodulation research.

- Mixed-methods evaluation combining qualitative insights with technical signal-quality benchmarking.

Research Datasets, Databases & Models

- Community-based EEG and fNIRS datasets demonstrating the feasibility of high-quality neuroimaging outside traditional laboratory environments.

Artistic & Creative Products

- Public engagement video on equity and diversity in brain research (https://www.youtube.com/embed/Mp6FU8QgzK0?si=m5-oOx9xKVpl7KBu).

Awards & Recognition

- ARIA funding award recognising leadership in addressing inequity and adoption barriers in neurotechnology.
- Recognition via EPSRC and ARIA communication channels as an exemplar of inclusive brain research.

Use of Facilities & Resources

- ISRAAC Community Centre (community-embedded research delivery).
- University of Sheffield neuroimaging laboratories.

Any Other Outputs or Impacts?

- Development of a **replicable, evidence-informed framework for inclusive neuromodulation research**, directly aligned with Neuromod+ strategic priorities and increasingly adopted as a reference point for inclusive neurotechnology practice.