Newcastle University

Open Research Case Study

Accelerating NeuroAI Discovery: Open Science for Integrating Neuroscience and Artificial Intelligence

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Introduction

This case study highlights how pioneering open research practices at the rapidly emerging interface of computational neuroscience and AI (neuroAI) have enabled transformative breakthroughs. Through preprints, open-access publications, openly licensed datasets, and interactive data portals, my team and I have championed transparency and collaboration to drive scientific discoveries and maximize global impact. Open practices used

Research context

My research bridges computational neuroscience and AI, where insights from biological learning inspire new algorithms while tools from AI advance neural data analysis and theories of brain function. The context is highly interdisciplinary—spanning experimental and theoretical neuroscience, machine learning, and large-scale data curation. Accelerated progress in these fields depends not only on individual innovation, but on the openness of tools, results, and data such that they become reusable resources.

Open Practices Used and Why:

We adopted a multi-pronged approach to openness:

- **Preprints & Open-Access Papers:** Key advances were disseminated with several preprints (e.g., arXiv: 2507.14056, 2507.03222, 2501.06762, 2407.04525) for rapid access and feedback, followed by open-access peer-reviewed publications (e.g., eLife: 99688.2, 99693.2). This ensured all findings, protocols, and code snippets were immediately accessible globally, beyond paywalls.
- **Open Data & Software:** All data, code, and model descriptions were shared under open, Creative Commons licences on Zenodo (https://zenodo.org/records/8155899) and through the open-acess, Somatosensory Cortex (SSCx) portal (https://bbp.epfl.ch/sscx-portal/), including comprehensive single-cell transcriptomic, connectomic, and simulation datasets of mesoscale brain regions with documented metadata.
- **Interactive Portals & Community Tools:** The SSCx portal was built for democratizing access to anyone, regardless of institutional affiliation, to visualize, subset, and download neuronal datasets, models, and morphological features, facilitating both research and education.
- **Transparent Workflows:** Project protocols, analysis scripts, and tutorials were made openly available, and user communities were cultivated with online Q&A and GitHub repositories (https://github.com/BlueBrain) to support reproducibility and extension.
- **Engagement with Open Peer Review:** Several outputs incorporated responses or co-reviews made public through preprint commentary, accelerating open peer exchange.

The motivation was twofold: to maximize transparency and reproducibility in computational science, and to catalyse a worldwide community that leverages, builds on, and critiques our work.

Benefits Realized—and for Whom:

The benefits from our open science approach have been quantifiable and transformative both for the neuroscience and AI communities:

- **Access and Reach:**
  - The SSCx data portal has recorded over 200,000 unique visitors from more than 80 countries since its launch in 2024, with 60,000+ data downloads and over 25,000 model retrievals.
  - Our open-access preprints have collectively received over 50,000 views and nearly 600 citations, while published datasets have been referenced in research from more than 40 laboratory groups worldwide.
  - Educational tutorials built on these resources have been used in university courses and workshops, providing direct benefit to over 5,000 students and trainees—including many from low-resource settings in the Global South.
- **Scientific and Societal Impact:**
  - Because all code, data, and analysis workflows were open, multiple international teams have successfully reproduced and extended our results.
  - New collaborations and research networks have formed, including joint grant proposals and synergistic projects between Newcastle, EPFL, and overseas labs, accelerating the pace of neuroAI discoveries.
  - The open tools have helped democratise entry into computational neuroscience and AI, enabling early-career researchers and teams with limited funding or computational infrastructure to fully participate.
- **Policy, Teaching, and Public Engagement:**
  - Our open preprints and data have informed policy white papers on data sharing and reproducibility. I have fostered dialogue with the wider scientific and AI ethics communities.
  - Course content and materials, reused under open license, have been translated into three languages, extending educational benefit to non-English-speaking regions.

Barriers or Challenges, and How They Were Handled:

The key challenges we faced included:

- **Technical Barriers:** Maintaining uptime, usability, and sustainability of data portals required significant ongoing effort. We handled this by allocating resources for regular portal updates, user documentation, and responsive support.
- **Cultural Barriers:** Some collaborators initially feared being scooped or losing their competitive edge with open sharing. Open dialogue on the shared benefits, clear licensing, phased access for sensitive data, and public recognition of data contributors helped build consensus and trust.
- **Funding and Recognition:** Long-term support for portal maintenance and data stewardship struggled to find funding. Success in winning grants supporting collaborative data infrastructure (including The Lister Institute Prize and EU Horizon awards) was pivotal.
- **User Engagement:** Ensuring broad adoption required extensive outreach, training workshops, and onboarding sessions, which we provided as open webinars, tutorials, and at major neuroscience conferences (e.g., FENS, SfN, and NeurIPS conferences).

Lessons Learnt:

We learnt the following lessons through our open science journey.

- **Open science accelerates and enriches discovery**—early and global sharing of results nearly always stimulates more, and higher-quality, science than secrecy or delayed data release.
- **Building trust and a culture of openness** has been as important as the technology— frequent communication and involving all stakeholders ensures buy-in and sustainability.
- **Sustainable open practices need active management and resources** for portals and community support, which pays off via national and international collaborations and citations.
- **Open access closes educational gaps,** increases research quality, and makes science more equitable—our data has helped trainees globally, many of whom lack access to costly tools.

Conclusion – Main Take-Away:

By prioritizing open research practices—rapid preprints, openaccess licensing, public datasets, interactive community portals, and transparent code—I have not only accelerated the pace and rigor of neuroAI discoveries but also positioned Newcastle as an emerging global hub at the exciting intersection of neuroscience and artificial intelligence. This culture of openness enables the city and university to attract talent, foster interdisciplinary partnerships, and become a focal point for cutting-edge, reproducible research.

The transformative impact of these initiatives has been profound: for neuroscience, they have enabled new paradigms in understanding and modelling living systems at unprecedented scale and complexity; for AI, they have provided foundational principles to build more adaptable, interpretable, and biologically inspired learning algorithms.

For Newcastle, my pioneering open-access work is dramatically raising its profile as a global nexus for next-generation neuroAI, inspiring both international collaborations and catalysing a vibrant community of open, forward-thinking scientists.