

Practical Paths to Open Research in Neuroimaging at the University of Reading



Dr Inge Lasser, MRI Facility Manager at the Centre for Integrative Neuroscience and Neurodynamics (CINN), discusses the role of CINN Imaging in promoting an Open Research culture among researchers and students.

Sustainable progress in science depends on transparent and reproducible research processes and methodologies. At the CINN Imaging laboratories the focus of our work is in cognitive neuroscience. Our key method is collecting neuroimaging data. This can be challenging because of several aspects intrinsic to the research:

- applying neuroimaging research to cognitive neuroscience is technically and theoretically complex;
- datasets are multi-dimensional and require multiple analytical treatments;
- applying neuroimaging techniques to human neuroscience is a relatively new field.

Best practices are continually evolving. Many of the methods and analytics that we use are novel, and often imported from other disciplines, such as statistical physics and machine learning.

Open Research principles play a vital role in our laboratories. At CINN Imaging, we understand and embrace both the potential and the challenges of open practice. We understand that researchers need to be informed about the benefits an open approach can have for them and for their science community, and that they need to learn good practice in a supportive environment. An important component of training our early career researchers is embedding them in a culture of Open Research, and giving them the tools, and the confidence, to use open practices in their work.

We have implemented several strands of action to promote the growth of an Open Research culture, and are seeing the benefits of this approach in research that is more transparent and reproducible. We include these processes as key parts of our remit:

- We develop pre-processing and analysis pipelines and tools that enable our trainees to curate their data to the highest standard, and make it readily interoperable and re-usable by others. For example, we have developed a tool that automatically converts raw data, as it comes out of the MRI scanner, into the widely-adopted **Brain Imaging Data Structure** (BIDS). This enables our researchers to easily convert their data into a format that is readable by the many openly available analysis tools, and to share it in a way that makes it useful to the entire community. We make these tools openly accessible online (via GitHub)^{1,2} for use by the neuroimaging community.
- In weekly seminars we discuss potential and ongoing studies, share methods and results, and hold dedicated sessions on data quality, research ethics, and Open Research practices. These meetings also include more formal protocol approval sessions, which enable our researchers to develop experimental designs of the highest standard, so that in time they can confidently use more formal pre-registration procedures in various publishing models.
- We lead by example, publishing in fully Open Access journals where possible (e.g. *PLoS ONE*)³ uploading manuscripts to preprint servers (e.g. *bioRxiv*)⁴ to accelerate the dissemination of our research, and making our code and datasets available through appropriate open repositories (e.g. GitHub and the Open Science Framework, or OSF)⁵.

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Open at a glance

- Staff and students at MRI facility working together to build a culture of Open Research
- Publishing Open Access, using preprint servers and making code and data openly available as standard
- Weekly seminars on sharing methods and results, cultivating good practice in study design and pre-registration
- Developed tools to convert MRI data to standard open format – code freely accessible under Open Source licences



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References and further information

1. Lindner, M. (2018). pyfMRIqc: calculates and provides information for quality check of functional MRI data. Source code. https://github.com/DrMichaelLindner/fMRI_QC
2. Lindner, M. (2018). pyBIBSconv: GUI based converter for MR dicoms to BIDS structure. Source code. <https://github.com/DrMichaelLindner/pyBIBSconv>
3. Lindner, M. et al. (2017). *In vivo* functional neurochemistry of human cortical cholinergic function during visuospatial attention. *PLOS ONE* 12(2): e0171338. <https://doi.org/10.1371/journal.pone.0171338>
4. Bell, T. et al. (2018). Thalamostriatal interactions in human reversal learning. Preprint. *bioRxiv*. <https://doi.org/10.1101/246371>
5. Bell, T. et al. (2018). Functional neurochemical imaging of the human striatal cholinergic system during reversal learning. *European Journal of Neuroscience* 47: 1184-1193. <https://doi.org/10.1111/ejn.13803>. Supporting data: <https://osf.io/hd5rj>; code: <https://github.com/DrMichaelLindner/MRSParVolCo>