David Coggan, Ph.D.

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Skills Summary

- **Languages**: Proficient in Python, MATLAB, R; familiar with C++, LaTex, Bash, html.
- **Tools**: Proficient in PyTorch, pandas, PIL, matplotlib, ggplot, FSL, Freesurfer, Psychopy, PsychToolbox.
- **Experimental techniques**: fMRI, EEG, MEG, behavioural, computational modeling.
- **Machine learning**: Supervised learning, contrastive learning, SVM, PCA, tSNE, ICA, k-means clustering.
- **Computer vision (CV) tasks**: Image classification, self-supervised learning, image generation/manipulation.
- **CV architectures**: convolutional neural networks (CNNs), locally-connected networks, auto-encoders, generative models.
- **Statistics**: ANOVA, parametric testing, permutation testing, multivariate and univariate analyses of neural data.
- **Other**: Public speaking, academic writing, leading research teams, teaching, technical support, human subjects research.

Experience

- **Postdoctoral Scholar** — Advisor: Prof. Frank Tong
  Vanderbilt University, Nashville, TN, USA — *March 2019 - present*
  - Automating the efficient search for optimal CV model architectures that better predict human visual behaviour and neural responses. (Pytorch, CNNs, Brain-Score)
  - Implementing gaze direction, attention and memory into CV models to improve image classification performance and reflect the human visual system more broadly. (Pytorch, CNNs)
  - Investigating the computational underpinnings of human visual robustness to image degradation, such as noise and occlusion. Augmenting CV model architectures and learning environments to improve robustness and resemblance to human visual system. [Pub. 1] (Pytorch, CNNs, fMRI, FSL, FreeSurfer)
  - Performed the first investigation in humans of a new cortical network recently discovered in the macaque brain. [Pub. 2] (fMRI, FSL, FreeSurfer, Pytorch, PCA, Psychopy, psychtoolbox)
- **Research Analyst**
  York Neuroimaging Centre, York, UK — *July 2017 - July 2018*
  - Provided technical support to research groups analyzing neuroimaging data. (Python, MATLAB, FSL, FreeSurfer)
  - Operated MRI scanners in both clinical and research settings. Clinical work was patient-facing, involving interaction with vulnerable populations.
  - Created training and assessment materials for an MRI scanner operation course and conducted in-person classes.

Education

- **PhD, Cognitive Neuroscience and Neuroimaging** — Advisor: Prof. Tim Andrews
  University of York, York, UK — *October 2014 - February 2019*
  - Thesis explored how natural images such as faces, objects and scenes are represented in the brain. Utilized different neuroimaging (fMRI, EEG) and analysis techniques (GLM, MVPA, visual field mapping, SVM, PCA, ICA, k-means) to explore whether neural responses in high-level visual cortex could be explained by low-level principles. [Pubs. 3-7] (Python, MATLAB, Bash, FSL, FreeSurfer)
  - Pioneered the use of multivariate pattern analysis of EEG data to measure how distributed neural representations evolve over time. [Pub. 7]
  - Led research teams of Master's students in designing, conducting, analyzing, and reporting successful neuroimaging experiments. [Pubs. 3,4,6]
  - Collaborated with other research groups to conduct experiments beyond the scope of the PhD thesis. [Pub. 9]
- **MSc, Cognitive Neuroscience (Graduated with Distinction)** — Advisor: Prof. Tim Andrews
  University of York, York, UK — *September 2013 - August 2014*
  - Research project constituted an fMRI experiment which demonstrated that the appearance of complex, semantic representations in high-level visual cortex was in fact driven by more basic visual features. [Pub. 8] (fMRI, phase-scrambling, MVPA, FSL)
- **BSc, Psychology (Graduated with First-Class Honours)** — Advisor: Dr. Kris Kinsey
  University of the West of England, Bristol, UK — *September 2010 - June 2013*
  - Research project involved designing and animating novel 3D shapes to investigate the effect of viewpoint and depth-rotation on human object recognition. (Shade 3D, E-Prime)

Honours and Awards

- K M Stott Award for Best PhD thesis (2018/2019), University of York, UK.
- Best Poster Presentation, Applied Vision Association (2018), University of Bradford, UK.

Voluntary Work / Public Outreach

- Brain Blast (2022), Nashville Public Library, Vanderbilt Brain Institute, Nashville, TN, USA.
- School for Science and Math at Vanderbilt (2020), Center for Science Outreach, Nashville, TN, USA.
- Demo Night (2015-2017), Vision Sciences Society, St Pete Beach, FL, USA.

Selected Publications

1. Coggan, D. D., & Tong, F. (In preparation). Evidence of amodal completion of occluded objects in both low- and high-level visual areas. *Journal of Neuroscience*.
2. Coggan, D. D., & Tong, F. (2023). Spikiness and animacy as potential organizing principles of human ventral visual cortex. *Cerebral Cortex*, 1-24. doi: 10.1093/cercor/bhad108
3. Coggan, D. D., Watson, D. M., Wang, A., Brownbridge, R., Ellis, C., Jones, K., . . . Andrews, T. J. (2022). The representation of shape and texture in category-selective regions of ventral-temporal cortex. *European Journal of Neuroscience*. doi: 10.1111/ejn.15737
4. Coggan, D. D., Giannakopoulou, A., Ali, S., Goz, B., Watson, D. M., Hartley, T., . . . Andrews, T. J. (2019). A data-driven approach to stimulus selection reveals an image-based representation of objects in high-level visual areas. *Human Brain Mapping*, *40*, 4716-4731. doi: 10.1002/hbm.24732
5. Coggan, D. D., Baker, D. H., & Andrews, T. J. (2019). Selectivity for mid-level properties of faces and places in the fusiform face area and parahippocampal place area. *European Journal of Neuroscience*, *49*, 1587-1596. doi: 10.1111/ejn.14327
6. Coggan, D. D., Allen, L. A., Farrar, O. R. H., Gouws, A. D., Morland, A. B., Baker, D. H., & Andrews, T. J. (2017). Differences in selectivity to natural images in early visual areas (v1 – v3). *Scientific Reports*, *7*, 1-8. doi: 10.1038/s41598-017-02569-4
7. Coggan, D. D., Baker, D. H., & Andrews, T. J. (2016). The role of visual and semantic properties in the emergence of category-specific patterns of neural response in the human brain. *eNeuro*, *3*, ENEURO.0158-16.2016. doi: 10.1523/ENEURO.0158-16.2016
8. Coggan, D. D., Liu, W., Baker, D. H., & Andrews, T. J. (2016). Category-selective patterns of neural response in the ventral visual pathway in the absence of categorical information. *NeuroImage*, *135*, 107-114. doi: 10.1167/15.12.622

Conference Talks

1. Coggan, D. D., Tong, F. (2023) Unsupervised contrastive learning and supervised classification training have opposite effects on the human-likeness of CNNs during occluded object processing. Journal of Vision 23 (9), 5448.
2. Coggan, D. D., Watson, D. M., ..., Andrews, T. J. (2018) The importance of low-level image properties in the neural representation of objects. Experimental Psychological Society (London, UK).
3. Coggan, D. D., Watson, D. M., ..., Andrews, T. J. (2017) A data-driven approach to stimulus selection reveals the importance of visual properties in the neural representation of objects. Journal of Vision 17 (10), 29.
4. Coggan, D. D., Watson, D. M., ..., Andrews, T. J. (2017) The importance of visual properties in the emergence of higher-level representations in the ventral visual pathway. Experimental Psychological Society (London, UK).
5. Coggan, D. D., Baker, D. H., Andrews, T. J. (2016) Investigating the temporal properties of visual object processing using a multivariate analysis of EEG data. Journal of Vision, 16 (12), 1311.

Conference Posters

1. Coggan D. D., Tong, F. (2022) Occluded object completion occurs in full across human visual cortex but emerges gradually across layers of CORnet-S. Cognitive Computational Neuroscience, San Francisco, CA, USA.
2. Coggan D. D., Tong, F. (2022) Evidence for full amodal completion of occluded images in low- and high-level visual cortex. Vision Sciences Society, St Pete Beach, FL, USA.
3. Coggan D. D., Tong, F. (2021) Maps of object animacy and aspect ratio in high-level visual cortex. Journal of Vision, 21(9), 2811.
4. Andrews, T. J., Giannkopoulou, A., Ali, S., Goz, B., Coggan, D. D. (2019) Category-selective patterns of neural response to objects with similar image properties, but different semantic properties. Journal of Vision, 19(10) 114.
5. Coggan, D. D., Watson, D. M., Hartley, T., Baker, D. H., Andrews, T. J. (2018) A data-driven approach to stimulus selection reveals the importance of visual properties in the neural representation of objects. Applied Vision Association, Bradford, UK.
6. Coggan, D. D., Liu, W., Baker, D. H., Andrews, T. J. (2015) Category-selective patterns of neural response to scrambled images in the ventral visual pathway. Journal of Vision, 15(12), 622.