David Coggan, Ph.D.

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Skills Summary

- **Languages**: Proficient in Python, MATLAB, R; familiar with C++, LaTex, Bash, html
- **Tools**: PyTorch, pandas, PIL, matplotlib, ggplot, FSL, FreeSurfer, Git, Psychopy, psychtoolbox, Blender
- **ML**: Supervised learning, contrastive learning, SVM, PCA, tSNE, ICA, k-means clustering
- **CV architectures**: Feedforward/recurrent CNNs, locally-connected networks, autoencoders
- **CV functions**: Image classification, image reconstruction, salience maps, adversarial images, image processing
- **Statistics**: ANOVA, Bayesian models, permutation testing, multivariate and univariate fMRI analysis, Fourier analysis
- **Other**: Public speaking, academic writing, leading small teams, teaching, analysis 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 CNN hyper-parameters to create a CV model that better predicts 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 better mimic the human visual system (Pytorch, CNNs).
  - Developing a novel image database of 3D computer-generated objects. These will be used to train a CV model to learn object representations in an unsupervised, contrastive learning setting (Pytorch, Blender, CNNs).
  - Investigating differences between humans and CV models in their robustness to image perturbations, such as noise and occlusion. Improving model robustness and resemblance to human visual cortex through augmenting training datasets and model architectures (Pytorch, CNNs, fMRI, FSL, FreeSurfer).
  - Discovered new cortical network in human visual cortex based on image features extracted from CV model [Publication 1] (fMRI, FSL, FreeSurfer, Pytorch, Psychopy, psychtoolbox).
- **Research Analyst**
  York Neuroimaging Centre, York, UK — *July 2017 - July 2018*
  - Provided technical support to various research groups analyzing neuroimaging data (Python, Bash, 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 a range of neuroimaging (fMRI, EEG) and analysis techniques (GLM, MVPA, visual field mapping, SVM, PCA, k-means) to explore whether neural responses in high-level visual cortex could be explained by low-level principles. [Publications 2-7]
  - Led small research teams of Master's students to conduct successful neuroimaging experiments. [Publications 2,3,5]
  - Collaborated with other research groups to conduct research beyond the scope of the PhD thesis. [Publication 8]
  - Taught undergraduate seminars on the fundamentals of human visual perception and associated biology.
- **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. [Publication 6]
- **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.

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

Publications

1. Coggan, D. D., & Tong, F. (Under Review). Investigating the "no man's land" cortical network and the aspect ratio - animacy organizing principle in the human ventral visual pathway. *Cerebral Cortex*.

2. 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

3. 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

4. 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

5. 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

6. 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

7. 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

8. Baker, D. H., Karapanagiotidis, T., Coggan, D. D., Wailes-Newson, K., & Smallwood, J. (2015). Brain networks underlying bistable perception. *NeuroImage*, *119*, 229-234. doi: 10.1016/j.neuroimage.2015.06.053

Conference Talks

1. Coggan, D. D., Watson, D. M., Brownbridge, R., Ellis, C., Jones, K., Kilroy, C., Wang, A., Andrews, T. J. (2018) The importance of low-level image properties in the neural representation of objects. Experimental Psychological Society (London, UK).

2. Coggan, D. D., Watson, D. M., Hartley, T., Baker, D. H., 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(9).

3. Coggan, D. D., Watson, D. M., Baker, D. H., Hartley, T., 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).

4. 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. (2016) Category-selective patterns of neural response to scrambled images in the ventral visual pathway. Journal of Vision, 15(12), 622.