

Title:

Disentangling and modelling behaviourally-relevant visual and semantic dimensions of visual cognition in the human brain
(Kamila Maria Jozwik lab, the University of Cambridge)

Application deadline:

2 December 2025

Start date:

October 2026

Project:

Seeing the world allows most of us to experience the surrounding reality. For example, we must recognise our child's face among the other children to pick up the correct child from the nursery. To interact with the world, we must recognise what is in our environment. The proposed research aims to define the dimensions - here, characteristics of objects ("curved", "pink", "having eyes", "being animate", "having agency", or ones that are hard to name) that are crucial for our everyday functioning. This research is only possible now thanks to 1) advances in imaging techniques that fuel a more detailed understanding of the brain, 2) tools from artificial intelligence that enable building better computer simulations of the brain.

The lab will leverage these advancements to disentangle and model behaviourally-relevant visual and semantic dimensions of visual cognition in the human brain, while increasing the ecological validity of experiments (including mobile EEG and immersive technologies), in the light of three aims:

- 1) characterise behaviourally-relevant visual and semantic dimensions of visual cognition by the use of large-scale brain imaging datasets of responses to images and model these representations with AI models (deep neural networks (including topographical), multimodal models, Large Language Models),
- 2) define and model dimensions related to the perception of animacy when interacting with objects and people using videos (behaviour, fMRI, and MEG),
- 3) determine to what extent these brain representations and dimensions change when humans are immersed in the environment (mobile EEG and VR).

The PhD student is welcome to work on one (or more) of the three aspects of the research programme, and I am open to discussing PhD student interests related to these research questions. Please contact me via email before applying using the link below.

The lab studies visuo-semantic cognition combining cognitive science, neuroscience, and computational modelling. The lab's research has focused on probing specific visual dimensions in the context of face, animacy, and object representations more generally. We collect and analyse human behavioural and brain imaging (fMRI and M/EEG) data. We also analyse macaque electrophysiology data obtained through collaborations. We use machine learning techniques for data analysis and computational modelling with a special interest in biologically-inspired deep learning and AI models (NeuroAI). The computational models we work with include vision deep learning models (including topographical deep neural networks), multimodal vision and language models, and Large Language Models. Please find prior work here: (Google Scholar: https://scholar.google.com/citations?hl=en&user=oEifmSgAAAAJ&view_op=list_works&sortby=pubdate). We also started exploring applying our expertise in visuo-semantic cognition and AI to neurotechnology and mental health applications, specifically in the context of interfacing with the brain through non-invasive focused ultrasound stimulation, utilising generative AI for exposure therapy, and characterising visual, semantic, and affective dimensions in mental health conditions. I would be happy to discuss PhD projects related to these research spaces as well, especially if projects are linked to the research aims mentioned in the previous paragraph.

Ideal candidate:

- extensive experience in programming in Python or Matlab and data analysis (essential, beyond introductory coursework)
- experience with neuroimaging data design/collection/analysis (fMRI, M/EEG) and behavioural data collection and analysis
- experience in machine learning and AI
- highly motivated and curious

Contact:

Kamila Maria Jozwik (Royal Society University Research Fellow and an Assistant Research Professor)
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Please send in the initial email:

- your CV
- information about the relevant research experience
- journal and conference publications, preprints (if applicable), and research thesis
- please also ask 2-3 of your referees, ideally with whom you worked on research projects, to send me their reference letters (I understand I may not receive all of them before the application deadline)

Application link:

<https://www.mrc-cbu.cam.ac.uk/study-with-us/research-degrees/how-to-apply/>

This is a 4-year, fully funded position for UK home students (in accordance with funding body rules). However, international students are welcome to apply and try to secure funding through various studentships available at the University of Cambridge (students will be automatically considered during the application if an offer is made) and beyond (happy to support applications of candidates for whom an offer has been made). I will also be recruiting a postdoc in a similar research space for an October 2026 start, so in case you know researchers who may be interested in applying, they are welcome to email me.

Lab research environment:

Jozwik lab is based at the MRC Cognition and Brain Sciences Unit at the University of Cambridge (with an affiliation with the Psychology Department and links to broader Cambridge and international (US/Canada) scientific ecosystems, e.g., the Center for Brains, Minds & Machines, now MIT Quest for Intelligence). The Unit has an on-site 3T fMRI scanner (with access to a 7T fMRI scanner within cycling distance), an MEG scanner, EEG systems, Focused Ultrasound, TMS, and dedicated methods and computing support staff. The lab values commitment to rigorous, open science, supports diversity in all its meanings, and drives curiosity in a supportive, multidisciplinary, and international research environment.