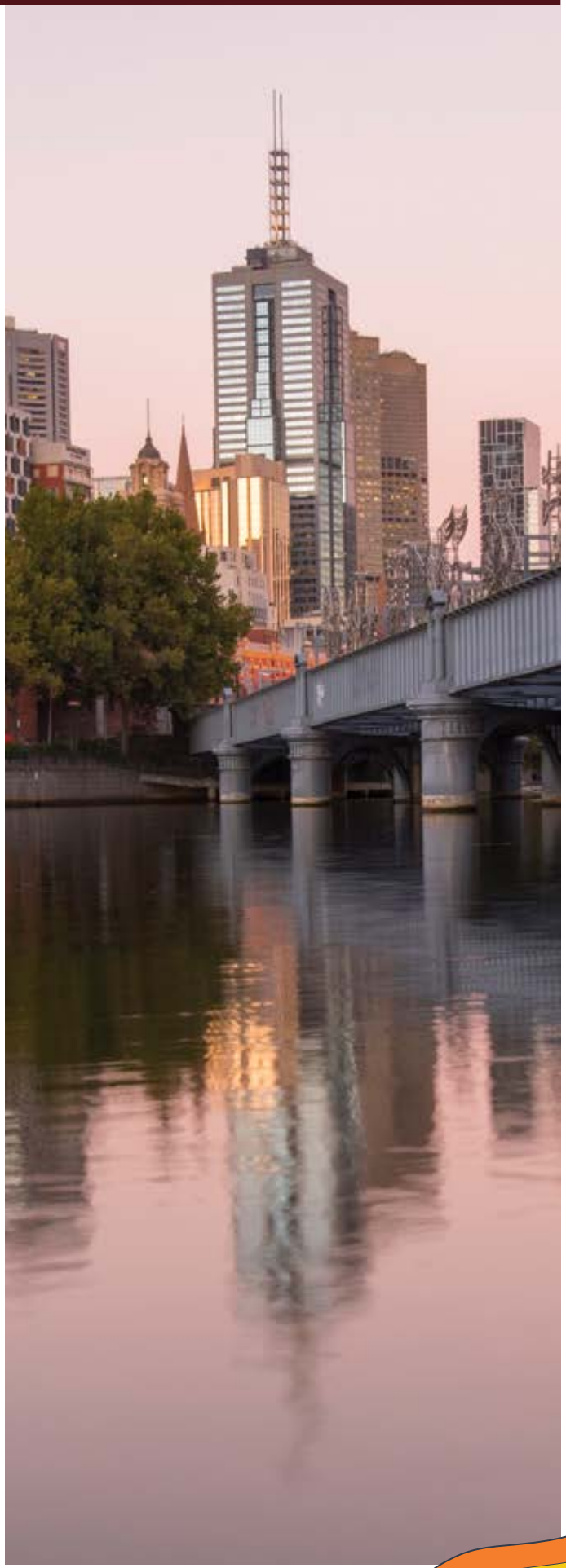
acns
melbourne 2025

NOVEMBER 25-28TH, 2025 | CONFERENCE PROGRAM

Quicklinks



Abstract Index

Acknowledgement of Country

We recognise that our conference is conducted on the unceded lands of the Peoples of the Kulin Nations, who have themselves been gathering and sharing knowledge for millennia. We acknowledge all the lands and waters on which we operate, and we pay our respects to their Traditional Owners; their Elders, past, present and emerging; and to all First Nations Peoples joining us for ACNS 2025.

The ACNS 2025 Logo

The ACNS 2025 logo competition was won by ECR member Phuong (Mimi) Dang from the University of Queensland.

"The logo was designed to represent ACNS as a conference to be held in Melbourne this year. It embodies a popular neuroimaging technique used to explore a variety of cognitive and perceptual phenomena in the field of cognitive neuroscience: EEG. In particular, the logo features a head topography of EEG source-localisation results in the typical colour scheme of ACNS. While EEG is best known for its high temporal resolution, source localisation can give insights into where active pools of signals may be located, whether in univariate or multivariate space. The logo uses these motifs to localise the site of conference activity this year: Melbourne on the tip of the Victorian state. While this may be the obvious hotspot, the logo acknowledges that the conference celebrates works from scientists from all over the Asia-Pacific region. It stays true to the 'Australasian' name by including the bottom half of the Asian continent, Australia, and New Zealand in 'active pools of signal'."

Mimi Dang

Welcome from the Organisers

Dear Colleagues, Students, Distinguished Guests, Valued Sponsors, and Supporters,

It is our great pleasure to welcome you to Melbourne for the Annual Meeting of the Australasian Cognitive Neuroscience Society (ACNS). Our annual conference is always the highlight of the Australasian cognitive neuroscience calendar, when we look forward to reconnecting with old colleagues, and forming new collaborations.

This year's meeting showcases the breadth and depth of our community's research - covering fundamental studies of brain and behaviour to cutting-edge neuroimaging, computational modelling and translational applications. Over the coming days, we invite you to engage with an exciting program that reflects the creativity, rigour, and collaborative spirit that define the ACNS community. We are especially delighted to welcome our distinguished keynote speakers, A/Prof Anne Collins and Prof Michael Breakspear, whose work has been so highly influential in our field.

This is the first time that our annual meeting has been co-hosted by two universities - Monash and Deakin - to whom we are incredibly grateful for their Platinum-level sponsorship. This partnership has allowed us to showcase the strengths of both universities, pool our resources, and provide opportunities for networking amongst staff and students across both sites. We would also like to acknowledge the hard work of the Local Organising Committee and team of volunteers spanning both universities, who have put in a sustained effort to make this conference a success. As always, we are also very thankful for the generosity of all of our sponsors, many of whom have been loyal supporters of our conference for many years. Without their support, this conference would not have been possible, nor would ACNS be the organisation that it is today.

One of the missions of ACNS is to facilitate the growth of cognitive neuroscience across our region. With this mission in mind we are proud to be partnering, for the first time, with remote sites in Asia. We welcome our friends and colleagues at Monash University Malaysia and De La Salle College in the Philippines. Both sites will be live-streaming the conference in parallel with our own event in Melbourne. We hope this will be the first of many exciting joint ventures to come.

We are delighted to announce that next year's annual meeting will be held in conjunction with the Australasian Neuroscience Society and Biological Psychiatry Australia, as part of the "Australasian Neuroscience Alliance 2026." The theme of this event is: "Merging Minds, Advancing Discoveries", and will offer a rare opportunity for us to network as a neuroscience community, share ideas, and forge new collaborations. We hope you will be able to join us in Sydney in December next year for this unique initiative.

In the meantime, we hope that you will enjoy this year's conference. Beyond the formal program, we hope you take the opportunity to enjoy the collegial and inclusive atmosphere that makes our community so special. Whether you are joining us for the first time or are a long-standing member, your participation ensures that we continue to enrich and strengthen the society as a whole. Thank you all for your valued support.

Trevor Chong, Megan Spencer-Smith, Talitha Ford, and Jarrad Lum

on behalf of the Local Organising Committee

Welcome from Monash University Malaysia

It is with great pleasure that we welcome you to the ACNS 2025 international satellite hub at Monash University Malaysia. We are delighted to provide a more accessible and convenient way for our region's cognitive neuroscience community to participate in the meeting and connect with colleagues across the globe. The hub's program has been carefully designed to bridge time zones with Melbourne. Live streams of the afternoon sessions in Melbourne will run during our mornings, while recordings of the morning sessions will be screened in the afternoon. Monash University Malaysia is proud to host this hub, reflecting our growing role as a centre for cognitive neuroscience in Southeast Asia. We hope the hub will not only allow participants to experience ACNS in real time but also spark new collaborations and strengthen ties across our diverse research community.

Welcome, and enjoy ACNS 2025!

Welcome from De La Salle University, Philippines

De La Salle University Manila (DLSU) is proud to collaborate with ACNS as an international satellite hub for this year's conference.

DLSU is a premier private teaching and research university located in the heart of Manila, Philippines. With a vibrant academic community of over 20,000 students across undergraduate and graduate programs, the university champions academic excellence and meaningful global engagement. As an ACNS satellite hub, it offers a lively intellectual environment that fosters cross-cultural exchange, innovative thinking, and interdisciplinary collaboration in the cognitive sciences and related fields.

DLSU is honoured to serve as one of ACNS 2025's Southeast Asia satellite hubs, underscoring our commitment to advancing research and global collaboration in cognitive neuroscience. We hope your time at the hub will be both intellectually stimulating and personally enriching.

Welcome to ACNS 2025!

Partner

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Muireann Irish, University of Sydney

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Talitha Ford, Deakin University

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Sharna Jamadar, Monash University

Education:
Huw Jarvis, Monash University

Local Organising Committees

ACNS Melbourne 2025

Co-Chairs: Trevor Chong, Talitha Ford, Jarrad Lum, Megan Spencer-Smith

LOC Members: Daniel Bennett, Trang Cao, Emily Colton, James Coxon, Alex Fornito, Jocelyn Halim, Huw Jarvis, Hannah Kirk, Jeryl Lim, James Pang, Jacob Paul, Shantha Rajaratnam, Adeel Razi, Erfan Rezaei, Elise Rowe, Kevin Walsh, Ashleigh Vella

Volunteers: Soudeh Ashrafipour, Tamrin Barta, Kaila Bianco, Gabriella Chan, Jace Cruddas, Elizabeth Ellis, Lyndon Firman-Sadler, Mehul Gajwani, Katherine Kenyon, Janneke Lemmerzaal, Mugdha Mukherjee, Samaneh Nahravani, Alexander Pascoe, Jack Phillips, Briella Celeste Rodriguez, Yinuo Shu, Navyaan Siddiqui, Berkins Sylas, Chunnian Zeng, Jade-Jocelyne Zouki

Monash University Malaysia

Da Wei Zhang, Yvonne Tan Yen Jie, Tay Suat Fui; Department of Psychology

De La Salle College, Philippines

Marissa Calleja, Maria Guadalupe Salanga, Kate Jamisola; Department of Psychology

Student Stipend Recipients

Congratulations to the recipients of our ACNS Student Stipends for 2025!

Harsh Arora,
Indian Institute of Technology Kanpur, India

Kavindu Bandara,
University of Melbourne

Mehul Gajwani,
Monash University

Tim Gastrell,
University of Queensland

Kseniia Konopkina,
University of Otago, New Zealand

Chloe Langbein,
Macquarie University

Xiaoxi Ma,
University of New South Wales

Samaneh Nahravani,
Deakin University

Zihe Wei,
University of Queensland

Alvin Wong,
University of Queensland

Australasian Neuroscience Alliance 2026

A joint initiative of ANS, BPA and ACNS

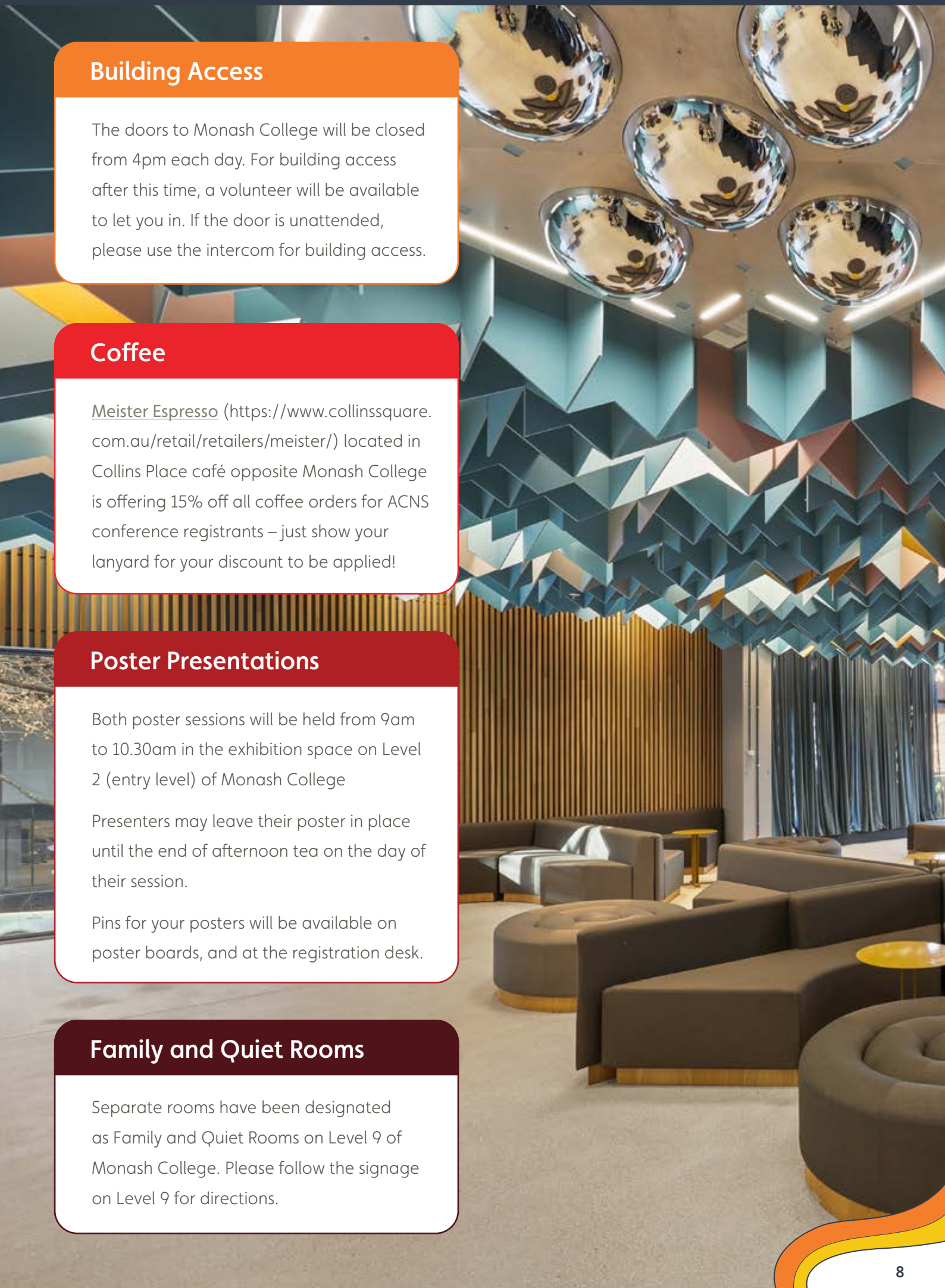
Sydney

December 2026

Australasian Neuroscience Society

Biological Psychiatry AUSTRALIA

australasian cognitive neuroscience society



Building Access

The doors to Monash College will be closed from 4pm each day. For building access after this time, a volunteer will be available to let you in. If the door is unattended, please use the intercom for building access.

Coffee

Meister Espresso (https://www.collinssquare.com.au/retail/retailers/meister/) located in Collins Place café opposite Monash College is offering 15% off all coffee orders for ACNS conference registrants – just show your lanyard for your discount to be applied!

Poster Presentations

Both poster sessions will be held from 9am to 10.30am in the exhibition space on Level 2 (entry level) of Monash College

Presenters may leave their poster in place until the end of afternoon tea on the day of their session.

Pins for your posters will be available on poster boards, and at the registration desk.

Family and Quiet Rooms

Separate rooms have been designated as Family and Quiet Rooms on Level 9 of Monash College. Please follow the signage on Level 9 for directions.

Transport

Monash College is conveniently located in the heart of Melbourne which means you'll find it easy to travel to the campus using train, tram or bus.

By train

Catch any Melbourne train that goes through the City Loop and hop off at Southern Cross station. 750 Collins Street is only a 300m walk from there.

By tram

Monash College is located within Melbourne's Free Tram Zone. Travel anywhere within this zone does not require a Myki card. Trams #11 and #48 from the north and east of the city stop on the doorstep of 750 Collins Street.

By bus

There's a bus stop directly in front of the building that services routes from the west of the city: 232 (Altona to City), 235 (Fishermans Bend via Williamstown Rd to City) and 237 (Fishermans Bend via Lorimer Street to City). If travelling from the airport, the Melbourne Airport Skybus Terminal is located at Southern Cross Station.

By car

If driving, parking is available at the Wilson Carpark located underneath 750 Collins Street, Docklands. The carpark is open from 0700-1900.

WiFi

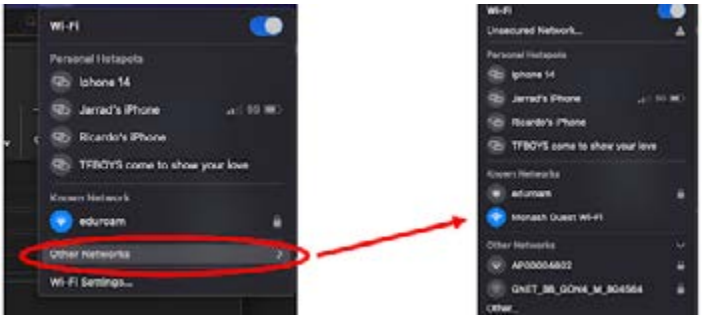
If you are visiting from a participating **eduroam** institution, you can connect to the eduroam network using your login credentials

First, select the eduroam wifi network from available networks

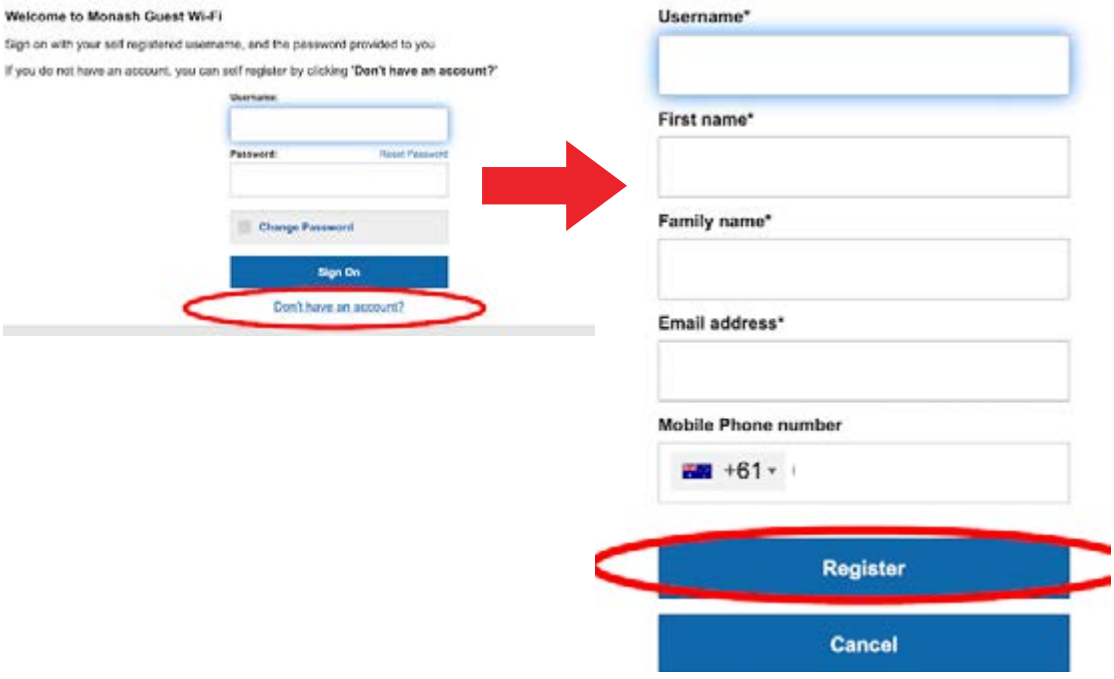
Enter your full username including domain (e.g., jsmith@institution.edu.au), then enter your password.

If you do not have an eduroam account, you can log on to the Monash College guest network. To do this select "Monash Guest Wifi".

If you are a Mac user, please note that this network may not automatically appear in your network list. If this is the case, go to "Other Networks" and then select "Monash Guest Wifi" (see image below).



Once you have selected "Monash Guest Wi-Fi" a dialogue box will appear. Select 'Don't have an account', add in your details and then and then access will be granted (see image below).



Monash College (City):

Main Conference Location

750 Collins St. Docklands

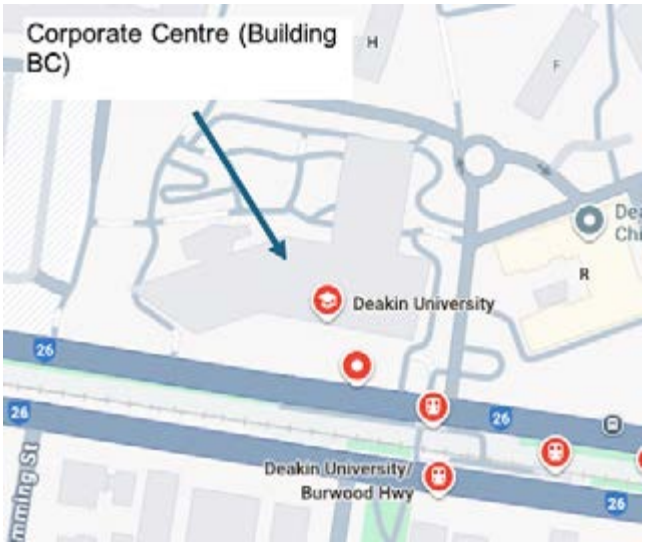
- Registration, Keynotes
- Symposia, Posters
- Open Talks & Fast Talks

Deakin University (Burwood Campus):

Pre-Conference Workshops

Level 2, Corporate Centre (Building BC), Deakin University, 221 Burwood Highway, Burwood

- ECR Grant Writing Workshop: Strategies for Success with ARC Experts
- From Sensor to Signal: Practical EEG Data Acquisition and Analysis Using High-Density Systems Workshop
- Creating Experiments Using PsychoPy & Pavlovia

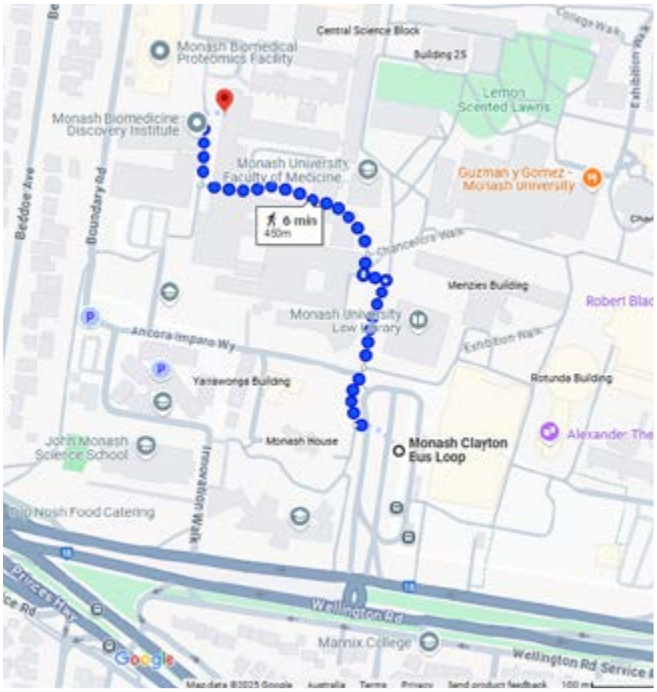


Monash University (Clayton):

Pre-Conference Workshop

Colloquium Room 653, Level 6, Building 17 (Biology & Psychology), 18 Innovation Walk, School of Psychological Sciences, Monash University, Clayton Campus

- Transcranial Ultrasound Stimulation Workshop



Proudly sponsored by Symbiotic Devices and Brainbox

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Getting to Monash Clayton:

Car

If arriving by car, there are metered parking zones ($20 for the day). See the pink areas on this map: https://www.monash.edu/__data/assets/pdf_file/0004/2658973/Clayton-campus-map.pdf

More info here:
https://www.monash.edu/about/our-locations/transport-parking/parking/meter

Public Transport

From a city loop train station (e.g. Flinders St), take the Cranbourne or Pakenham line trains away from the city towards Cranbourne or Pakenham. You can also board these trains from Richmond, South Yarra, Caulfield, or any of the other stops along the way. Take the train to Huntingdale Station, and then take the 601, 630 or 900 bus to campus (touch on and off both the train and bus using a Myki card). See the map on the previous page for the short walk (500m) across campus from the Bus terminal to the Psychology building. Enter through the Orange entrance, and take the lift to Level 6.

Once inside Building 17 turn right

Take the lift to level 6

Turn right. The Colloquium room (653) is at the end of the corridor on your right.

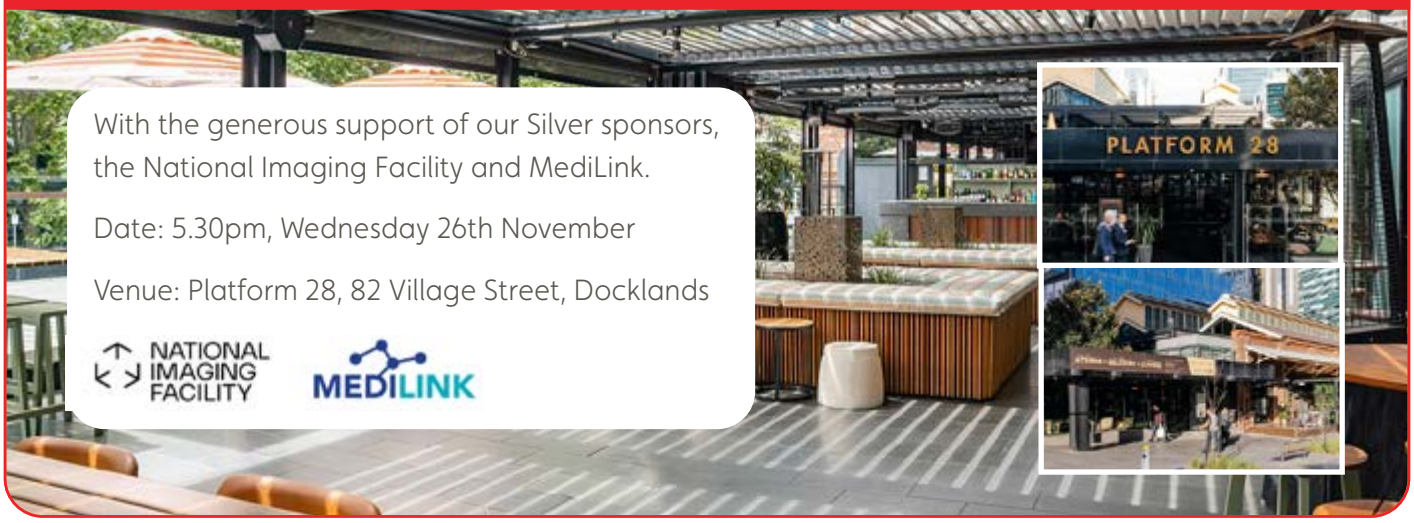
Building 17

Early Career Mixer

Date: 5pm, Tuesday 25th November

Venue: Hightail Bar, 727 Collins Street, Docklands

Welcome Reception



With the generous support of our Silver sponsors, the National Imaging Facility and MediLink.

Date: 5.30pm, Wednesday 26th November

Venue: Platform 28, 82 Village Street, Docklands

NATIONAL IMAGING FACILITY

MEDILINK

Conference Dinner – Taxi Restaurant

With the generous support of our Platinum partners, Monash University and Deakin University

Date: 7pm, Thursday 26th November

Venue: Taxi Kitchen, Level 1 Federation Square, Melbourne

MONASH University

DEAKIN UNIVERSITY

Workshops: Tuesday 25 November

Deakin University, Burwood Corporate Centre

Time: 10am-1pm

From Sensor to Signal: Practical EEG Data Acquisition and Analysis Using High-Density Systems Workshop.

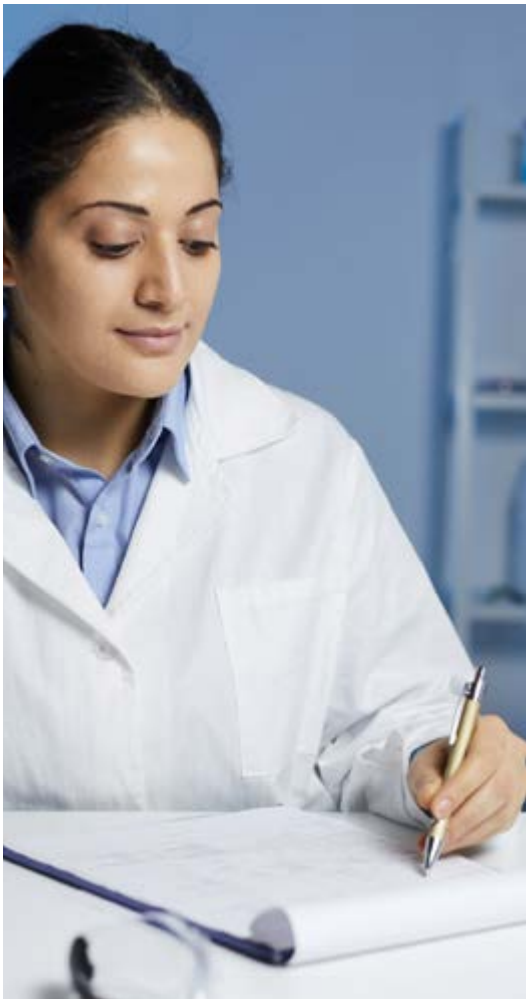
This workshop provides an end-to-end walkthrough of EEG data acquisition and analysis. Attendees will observe the complete setup of a participant using a 128-channel EEG system, with practical discussion around the logistical and methodological considerations. We will guide participants through multi-subject preprocessing using MATLAB and associated EEGLAB toolboxes, followed by ERP and time–frequency analysis using FieldTrip. Emphasis will be placed on appropriate statistical inference, with visualisation of group-level effects. The session also critically addresses an important design consideration: how many electrodes are enough? We will discuss the trade-offs involved when selecting between low- and high-density systems (e.g., ~20, 32, 64, or 128 channels), including the impact of gel- vs. saline-based setups on data quality, participant comfort, and experimental throughput. This workshop is ideal for early career researchers commencing EEG research, or those setting up a lab, offering practical insight into efficient and rigorous EEG research practices. All data and code used during the session will be provided to participants.

Creating Experiments Using PsychoPy and Pavlovia

PsychoPy is a free, open-source tool for creating and running experiments in the lab, and pavlovia.org is a low-cost server for hosting and sharing experiments online, as well as a place to create surveys (making it a low-cost Qualtrics alternative). This workshop will introduce you to these tools. Together, we will create an experiment in PsychoPy builder, learn how to add flexibility to that experiment with Python code snippets, and launch that experiment online. We aim to make materials useful for beginners but also include useful tips and tricks for those already familiar with PsychoPy and Pavlovia. You do not need to have experience in Python coding to attend this workshop (but we hope you learn some Python skills as part of the session!) If you plan on attending the workshop or have any questions in advance, please contact us via email: workshops@opensciencetools.org

Deakin University, Burwood Corporate Centre

Time: 2pm - 3.30pm



ECR Grant Writing Workshop: Strategies for Success with ARC Experts

Join us for an in-depth Grant Writing Workshop designed to help researchers craft competitive, compelling grant applications. Featuring two distinguished experts from the Australian Research Council (ARC) Professor Katherine Johnson and Professor Gavan McNally, this session will provide insider insights into what makes a successful grant proposal and how to align your application with ARC priorities.

This workshop will cover key elements of persuasive grant writing, common pitfalls to avoid, and practical tips for improving clarity, structure, and impact.

Key Highlights:

- Insights from two seasoned ARC College of Experts members

- Understanding the review process and assessment criteria

- Strategies for framing your research and demonstrating impact

- Interactive Q&A session

Don't miss this opportunity to elevate your grant writing skills and those interested in applying for 2027 DECRA applications.

Monash University (Clayton)

Time: 9.30am-4pm

Transcranial Ultrasound Stimulation Workshop

This workshop aims to provide an introduction to the use of Transcranial Ultrasound Stimulation (TUS) for neuromodulation. The workshop will involve lectures combined with interactive sessions designed to give attendees a foundational understanding of the physical and biomechanical bases of ultrasound neuromodulation, the challenges of implementing the technique, and its potential and current application in cognitive and clinical neuroscience. It is assumed that attendees will have no prior experience with the technique and are curious to gain exposure for the first time. The workshop will provide an introduction to kWave simulations of the ultrasound acoustic field through the human skull, and a live demonstration of transducer coupling and neuronavigated targeting of a deep brain region. Attendees should leave with an enhanced understanding of the considerations required to design, perform, and analyse transcranial ultrasound stimulation studies in a safe and replicable way.

Proudly sponsored by Symbiotic Devices and Brainbox

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A/Prof Anne Collins

Deconstructing reinforcement learning

10am, Wednesday 26th November

Keynote lecture proudly sponsored by Monash and Deakin Universities.

Abstract: Reinforcement learning frameworks have contributed tremendously to our better understanding of learning processes in brain and behavior. However, this remarkable success obscures a more complex reality: that the reinforcement learning framework does not capture a single, well-defined neuro-cognitive process. In this talk, I will present results from multiple studies, showing how computational, behavioral and neuro-imaging tools allow us to disentangle the multiple distinct processes that support humans' unique flexibility and adaptability. I will highlight how focusing on a single broad framework (reinforcement learning) – and consequently failing to account for multiple parallel, interacting processes – weakens the generalizability and interpretability of research findings. This comes with important consequences for our understanding of the neural mechanisms that support learning across species, and for individual differences across developmental and clinical populations.

Biography: Dr. Anne Collins is an Associate Professor in the Department of Psychology and Helen Wills Neuroscience Institute at UC Berkeley, where she leads the Computational Cognitive Neuroscience Lab. Building on a foundation in mathematics and engineering at the École Polytechnique (Palaiseau, France), she completed a Ph.D. in Cognitive Neuroscience at Université Pierre et Marie Curie in Paris, then a Postdoc at Brown University (Providence, RI, USA). Her research has since centered on the computational mechanisms that drive learning and flexible decision-making processes in humans. Dr Collins's research has earned her significant recognition, including the Cognitive Neuroscience Society's Young Investigator Award in 2021. Her discoveries have wide-ranging applications, from advancing our understanding of typical cognitive development to discovering the underlying causes of learning differences in clinical populations.

Prof Michael Breakspear

Wave-wave interactions between the cortex and hippocampus

2pm, Thursday 27th November

Keynote lecture proudly sponsored by Symbiotic Devices.

Abstract: The hippocampus is a core neural hub that supports cognitive function through reciprocal exchange with large-scale cortical networks. This process requires integration of hippocampal activity into the complex dynamics of diverse cortical regions. I will present computational analyses of the wave-to-wave interactions between cortical and hippocampus that support these dynamics. These waves, in turn, support the retrieval of memories and the generation of novel semantically cued mental states.

Biography: Michael Breakspear is a computational neuroscientist and clinical academic whose work spans theoretical neuroscience, brain imaging, and translational neuroimaging. His research team employs advanced mathematical techniques to integrate biophysical modelling with patient data to support prediction, diagnosis, and stratification.

Young Investigator Award Winner: Dr Reuben Rideaux

Title: Neural design principles for efficient perception across time

Date: 10.30am, Thursday 27th November

Abstract: Biological systems have evolved to optimise perception and action under resource constraints, giving rise to canonical neural design principles that minimise metabolic cost while preserving representational fidelity. Shaped by environmental structure, these principles are conserved across species and offer insights not only into brain function but also into the design of artificial neural systems. This talk will focus on three core operations that exploit information from the past to process the present more efficiently: serial dependence, adaptation, and efficient coding. Acting through distinct biological pathways, these mechanisms span temporal scales from milliseconds to years. I will present behavioural, neuroimaging, and computational modelling work investigating how they support perception and how their integration can inform the development of more efficient artificial neural networks.

Biography: Reuben Rideaux is a cognitive neuroscientist at the University of Sydney, where he leads the Rideaux Lab. His research investigates the computational and neural principles that support human perception, with a focus on vision. By combining behavioural experiments, brain imaging, and computational modelling, his work aims to uncover the canonical operations that underlie flexible and efficient information processing in the brain.

Emerging Researcher Award Winner: Dr Sophie Smit

Title: When Seeing Becomes Feeling: Understanding Vicarious Experience in the Brain

Date: 10.30am, Friday 28th November

Abstract: How does the brain transform what we see into what we feel? My research investigates subjective experiences and the neural computations that underlie vicarious touch—the striking experience of feeling touch on one's own body while merely observing it. Understanding these processes is essential for uncovering how the brain builds multisensory representations of self and other. My research shows that vicarious touch is surprisingly common in the general population, at least in experimental settings, and not restricted to rare cases such as mirror-touch synaesthesia as was initially proposed. Simulation theories propose that perceiving others' experiences recruits neural processes that overlap with those engaged during first-hand experience. In line with this, I found that only individuals reporting vicarious touch show neural overlap between observed and directly felt touch, suggesting that seeing touch indeed activates representations similar to feeling touch. I also found that information about observed touch is encoded differently: emotional-affective dimensions (arousal, threat, pain) are represented more strongly and with more sustained dynamics in vicarious responders, whereas encoding of visual and sensory features remains consistent across groups. These findings imply that vicarious experiences are linked not only to activation of tactile representations, but also to distinct information-encoding dynamics that may shape simulated touch

experiences. Together, these findings link subjective experience with objective neural effects, advancing our understanding of individual variation in sensory processing and informing both clinical applications and broader models of social cognition.

Biography: Dr Sophie Smit is a cognitive neuroscientist who recently began a postdoctoral researcher position at the University of Sydney, after holding postdoctoral roles at the MARCS Institute for Brain, Behaviour and Development at Western Sydney University and at Macquarie University. Her research investigates how the brain transforms what we see into what we feel, with a focus on vicarious touch—the experience of feeling touch on one's own body while merely observing it—and on how individual differences shape these experiences. By combining neuroimaging, multivariate decoding, and behavioural studies, she uncovers how sensory, emotional, and social information is represented in the brain. She is also interested in how these processes relate to empathy, multisensory processing, and mental imagery. Her research aims to bridge subjective experience with objective neural mechanisms.

MOTOR LEARNING AND PLASTICITY

Wednesday 26th November @ 11.30am

Monash College (Docklands) | Level 9 | Room 943

Understanding the neural correlates of motor learning and novel plasticity-inducing interventions to reduce movement impairment.

A long history of research has linked plasticity of the motor system with our capacity to learn to control voluntary movements. Growing evidence demonstrates that motor control and motor learning are underpinned by plasticity across complex motor networks. Yet, the specific mechanisms mediating these changes and how they are affected by in movement disorders remain unclear. This Symposium explores the motor networks important for motor learning and interventions that show promise for enhancing motor system plasticity and motor learning in healthy individuals and those with movement impairments. It will showcase the latest evidence in neural networks, plasticity and motor learning: empirical projects that use diverse approaches, encompassing non-invasive brain stimulation as well as genetic assessment and behavioural intervention, will shed light on motor learning in healthy children, adults, and individuals with motor impairments.

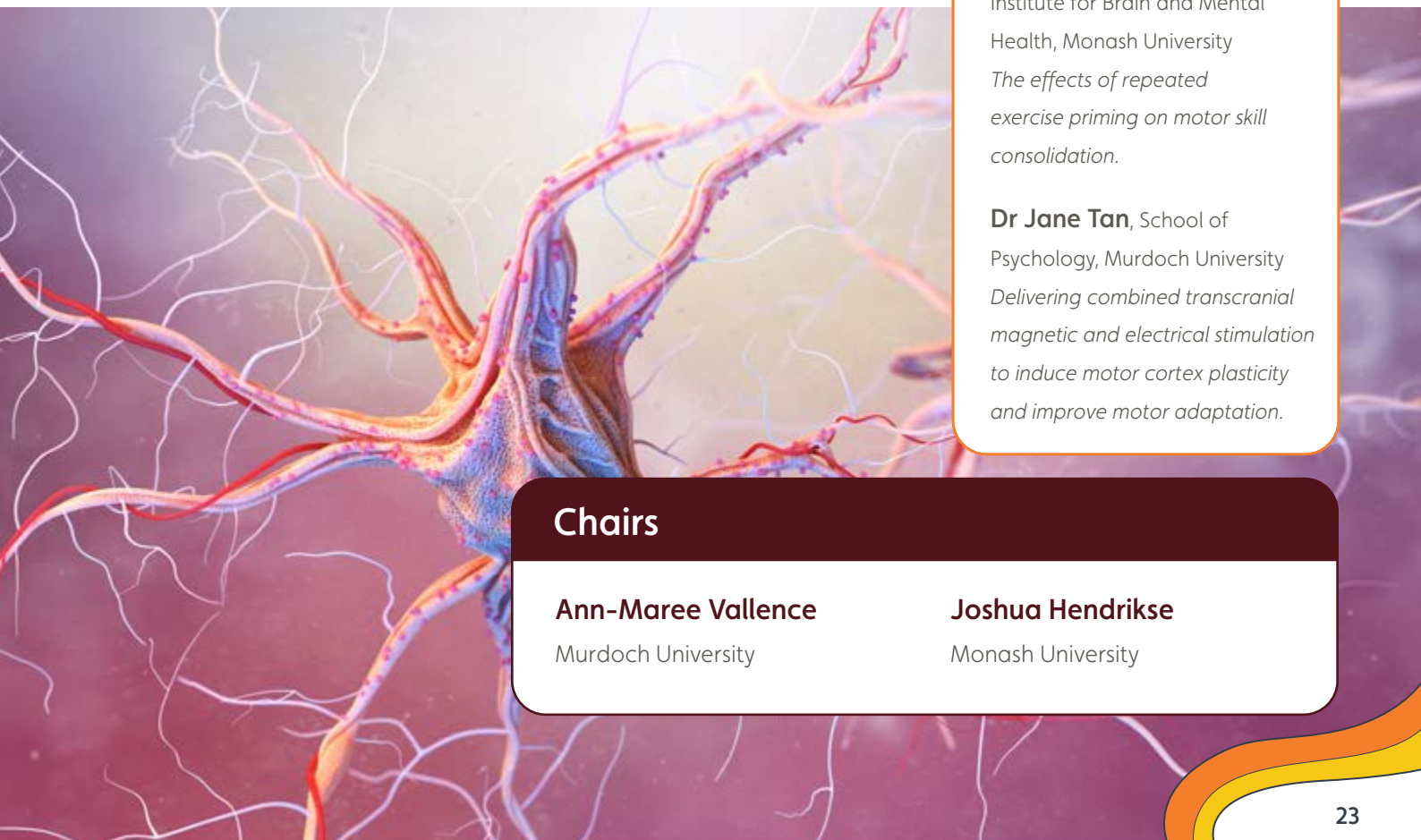
Speakers

A/Prof Jarrad Lum, Cognitive Neuroscience Unit, School of Psychology, Deakin University
Neural Oscillations in Motor Skill Acquisition in Typical and Clinical Populations.

Emily Brooks, Turner Institute for Brain and Mental Health, Monash University
An acute bout of high-intensity cardiovascular exercise facilitates online motor skill learning.

Dr Joshua Hendrikse, Turner Institute for Brain and Mental Health, Monash University
The effects of repeated exercise priming on motor skill consolidation.

Dr Jane Tan, School of Psychology, Murdoch University
Delivering combined transcranial magnetic and electrical stimulation to induce motor cortex plasticity and improve motor adaptation.



Chairs

Ann-Maree Vallence
Murdoch University

Joshua Hendrikse
Monash University

COMPUTATIONAL MODELLING OF COGNITION

Wednesday 26th November @ 11.30am

Monash College (Docklands) | Level 9 | Room 952

A model collaboration: how mathematical psychology can contribute to cognitive neuroscience and vice versa.

Some of the most influential findings in contemporary cognitive neuroscience arise from the interaction between mathematical and computational models of behavioural and neural data. From reinforcement-learning models of midbrain dopamine to probabilistic Bayesian models of neural coding and evidence-accumulation models of parietal neurons, mathematical and computational modelling has become an indispensable tool for researchers studying the neural underpinnings of cognition. However, for budding cognitive neuroscientists without prior training the complexity of modelling methods can present a barrier to entry that prevents them from using these tools in their own research. In practice, this can produce a divide between researchers who study the neural substrates of cognitive phenomena and those who develop mathematical models of cognition. In this symposium, we will bridge this divide by showcasing recent work at the interface of cognitive neuroscience and mathematical psychology. Our goals are twofold: first, we hope to provide interesting and inspiring exemplars of work combining computational modelling of cognition and behaviour with analysis of data collected using the tools of cognitive neuroscience. Second, by increasing the visibility of these fields to one another we will facilitate future collaborations between Australian mathematical psychology and cognitive neuroscience researchers.

Speakers

Professor Simon Farrell, UWA
Mutual advantage at the interface of cognitive modelling and neuroscience.

Dr Kelly Garner, UNSW Sydney
On the formation of routines and their impacts on control: harnessing cognitive neuroscientific insights to build mathematical models of cognition.

Christina Van Heer, the University of Melbourne
Rethinking representational assumptions in cognitive modelling:implications for cognitive neuroscience.

Jie Sun, the University of Melbourne
A parietal memory-strength signal linked to evidence accumulation in recognition decisions.

Dr William Ngiam, Adelaide University
Multivariate classification shows associative learning reduces working memory load.

Chairs

Daniel Bennett
University of Melbourne

Simon Farrell
University of Western Australia

CURIOSITY AND CREATIVITY

Wednesday 26th November @ 2pm

Monash College (Docklands) | Level 9 | Room 943

Navigating the environment: How does curiosity and creativity shape our behaviour?

This symposium advances a unifying framework for studying humans' behaviour when navigating novel environments. We show that the hallmark capacities driving us to explore novel response (i.e., curiosity) and supporting us to generate novel ideas (i.e., creativity) emerge from shared neurocognitive cornerstones rather than isolated faculties. By integrating evidence from functional neuroimaging, brain stimulation, computational modelling, and clinical research, the talks collectively highlight the dynamic interplay of memory, cognitive control, as well as reward and effort processing, in supporting adaptive behaviour. Importantly, this work bridges cognitive and clinical neuroscience: 1) revealing the common mechanisms of curiosity and creativity, and 2) demonstrating how creative capacities decline and maladaptive behaviour arises in neurodegenerative conditions. These insights pave the way for novel interventions to enhance curiosity and creativity, while informing clinical strategies to preserve motivation and adaptive behaviour across the lifespan.

Chairs

Professor Gail Robinson
Queensland Brain Institute,
The University of Queensland

Dr Melody Chan
School of Psychology,
The University of Queensland

Speakers

Gail A. Robinson, Queensland Brain Institute, The University of Queensland
The cognitive cornerstones underpinning curiosity and creativity; Creative idea generation in healthy and pathological ageing.

Melody M. Y. Chan, School of Psychology, The University of Queensland
The cognitive cornerstones underpinning curiosity and creativity: The neural basis of creative thought: A functional neuroimaging study.

Jocelyn A. Halim, Turner Institute for Brain and Mental Health, School of Psychological Sciences, Monash University
Neurocomputational mechanisms underlying perceptual and epistemic curiosity.

Eugene Cho, Queensland Brain Institute, The University of Queensland
Investigating the Role of Inhibitory Control in Creative Thought Using Transcranial Magnetic Stimulation.

Lee-Anne Morris, Department of Medicine, University of Otago
Effort-based decision-making: an experimental framework to understand motivation loss in Huntington's and Parkinson's disease.

PREDICTIVE PROCESSING

Thursday 27th November @ 11.45am

Monash College (Docklands) | Level 9 | Room 943

Predictive processing in the human brain.

Predictive processing has emerged as a unifying framework for understanding perception, cognition, and brain function. This symposium brings together cutting-edge empirical work that interrogates how expectations shape sensory representations across neural, behavioural, and physiological domains. The four talks span diverse methodologies—from large-scale behavioural modelling and EEG decoding to ultrahigh-resolution fMRI and OP-MEG—olering converging evidence that predictive mechanisms modulate perceptual fidelity, generalise across object attributes, and vary across clinical populations. Together, these findings challenge traditional views of perception as passive and instead highlight the brain's active role in constructing experience. By integrating insights from neurotypical and clinical populations, this symposium advances our understanding of the computational principles underlying perception and their relevance to mental health.

Speakers

Reuben Rideaux, School of Psychology, The University of Queensland
Concurrent neuro, behavioural, and physiological evidence worse representational fidelity of expected visual events.

Dragan Rangelov, Department of Psychological Sciences, Swinburne University of Technology
Expect the unexpected: What can the observations of 7000 people tell us about the effects of expectation on visual perception?

Phuong Dang, Queensland Brain Institute, The University of Queensland
Differential effects of expectation on perceptual and neural measures of visual object processing.

Elise Rowe, School of Psychological Sciences, The University of Melbourne
Perception and prediction in psychosis: Preliminary findings from the 'PRIOR' study.

Chairs

Dragan Rangelov
Swinburne University of Technology

Phuong Dang
University of Queensland

DEVELOPMENT

Thursday 27th November @ 11.45am

Monash College (Docklands) | Level 9 | Room 952

How children and adolescents use (mal?)adaptive strategies to enhance their performance.

How do participants complete our experimental tasks? While instructions often try to constrain possible approaches to reduce unwanted variance, participants use general and task-specific strategies and behavioural adjustments to attempt to maximise their performance. However, the strategies used may not always be adaptive. This symposium will reflect a range of cognitive neuroscience approaches to studying the development of strategy use during childhood and adolescence.

Strategy use reflects metacognitive knowledge, metacognitive control and executive function, which rely on brain networks that show prolonged structural and functional maturation into adolescence. Overall, this symposium will contribute to our understanding of the development of metacognitive skills and how they may be fostered to improve cognitive and academic outcomes for children and adolescents.

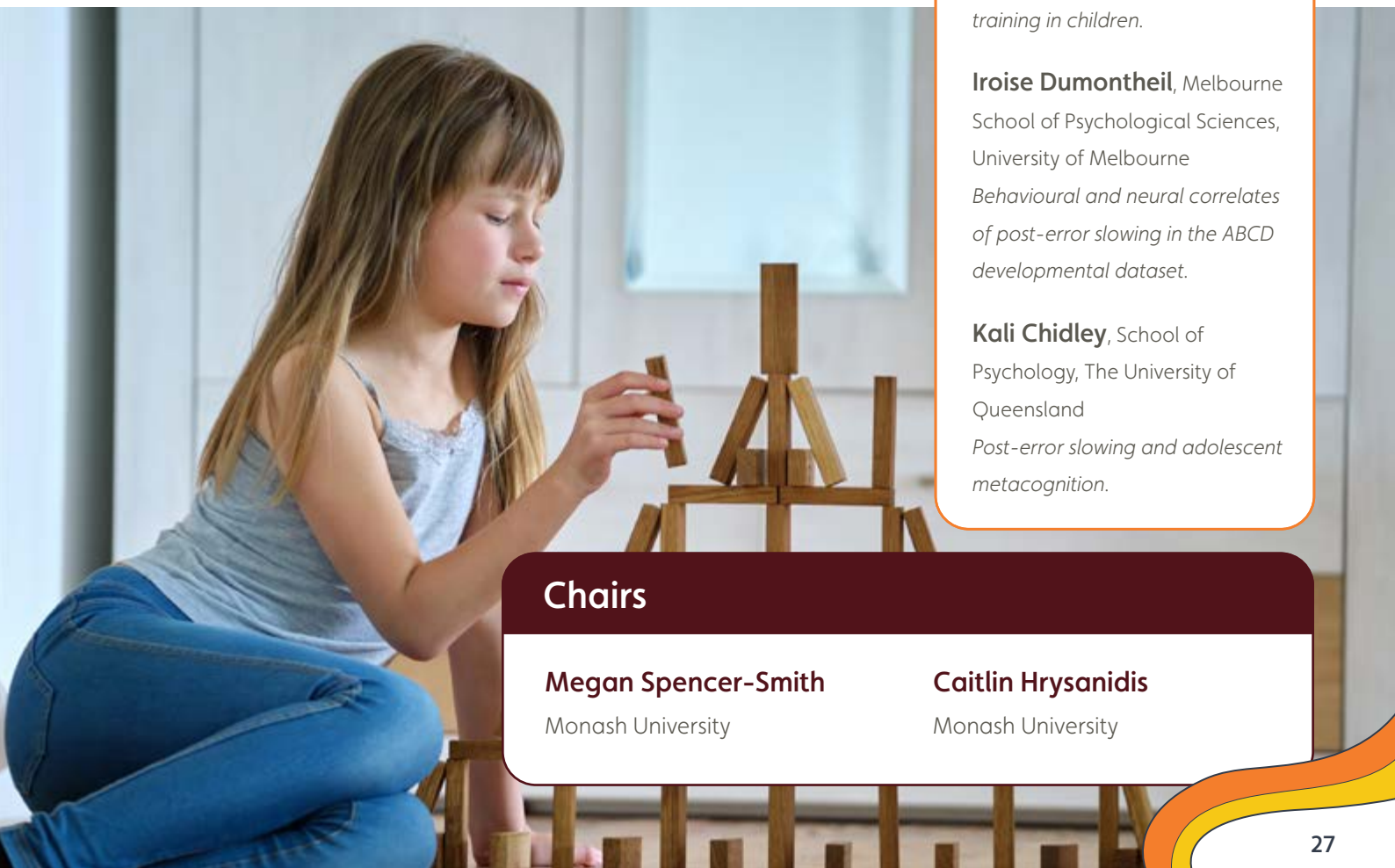
Speakers

Caitlin Hrysanidis, School of Psychological Sciences and Turner Institute for Brain and Mental Health, Monash University
Working memory strategies in children aged 7 to 10 years.

Megan Spencer-Smith, School of Psychological Sciences and Turner Institute for Brain and Mental Health, Monash University
Exploring the Strategy Mediation hypothesis as a cognitive mechanism of working memory training in children.

Iroise Dumontheil, Melbourne School of Psychological Sciences, University of Melbourne
Behavioural and neural correlates of post-error slowing in the ABCD developmental dataset.

Kali Chidley, School of Psychology, The University of Queensland
Post-error slowing and adolescent metacognition.



Chairs

Megan Spencer-Smith
Monash University

Caitlin Hrysanidis
Monash University

BRAIN STIMULATION

Thursday 27th November @ 3.15pm

Monash College (Docklands) | Level 9 | Room 943

Cognitive and clinical applications of non-invasive brain stimulation.

Non-invasive brain stimulation (NIBS) technologies are transforming how researchers can both examine and modulate brain function. These approaches provide powerful tools for probing brain-behaviour relationships and are increasingly applied as therapeutic interventions across neuropsychiatric, neurodevelopmental, and neurological disorders. Recent advances in targeting methodologies, integration with neuroimaging, development of novel stimulation protocols, and the emergence of large-scale data sharing initiatives have significantly expanded the precision, reproducibility, and translational impact of NIBS. This symposium will feature research from early- and mid-career investigators showcasing innovations in lesion network mapping and its application to neurological disorders, findings from a nation-wide multi-site clinical trial of repetitive transcranial magnetic stimulation (TMS) in autism, electrophysiological responses to TMS, and the development of a collaborative open-science platform for NIBS data sharing.

Chairs

Talitha Ford
Deakin University

Aron Hill
Deakin University

Speakers

Dr Ellen Younger, Cognitive Neuroscience Unit, School of Psychology, Deakin University
Translating network mapping findings into targets for therapeutic transcranial magnetic stimulation.

Dr Elizabeth Ellis, Cognitive Neuroscience Unit, School of Psychology, Deakin University; 2. Turku Brain and Mind Center, Clinical Neurosciences, University of Turku/Turku University Hospital
Neuromodulation in movement disorders: Using functional connectivity in stimulation targeting.

Dr Jordan Morrison-Ham, Cognitive Neuroscience Unit, School of Psychology, Deakin University
Efficacy of network mapping-guided continuous theta-burst stimulation in cervical dystonia: A randomised controlled pilot trial.

Miss Briella Rodriguez, Cognitive Neuroscience Unit, School of Psychology, Deakin University
The therapeutic application of repetitive transcranial magnetic stimulation in autism: Findings from a randomised controlled trial.

Dr Bridgette Speranza, Cognitive Neuroscience Unit, School of Psychology, Deakin University
The neurophysiological effects of theta burst stimulation as measured by electroencephalography: A systematic review.

Dr Michael Barham, Cognitive Neuroscience Unit, School of Psychology, Deakin University
The 'Big NIBS data' project: The world's first open-source data sharing repository for noninvasive brain stimulation data.

TRAUMATIC BRAIN INJURY

Thursday 27th November @ 3.15pm

Monash College (Docklands) | Level 9 | Room 952

Bridging the gap: Translating advanced MRI into clinical practice for Traumatic Brain Injury.

Magnetic resonance imaging (MRI) has transformed our understanding of brain alterations following traumatic brain injury (TBI). Advanced MRI techniques have revealed structural and functional changes across specific brain regions, white matter tracts, and large-scale networks, not only following injury, but also as a result of recovery and in response to rehabilitation. Imaging biomarkers are often linked to behavioural and cognitive deficits, offering valuable insights into the mechanisms of injury and recovery. Despite this promise, the clinical translation of advanced MRI remains limited. Several barriers hinder translation into routine care. First, many post-processing tools assume anatomically normal brains, limiting their accuracy in the presence of lesions. Second, high-field MRI systems—commonly used in research—pose challenges in clinical settings due to cost, safety, and limited accessibility. Third, most studies rely on group-level comparisons, which do not provide the individualized insights clinicians need for diagnosis, prognosis, and treatment planning. This symposium will explore innovative strategies to overcome these barriers and bring advanced MRI closer to clinical practice.

Chairs

Karen Caeyenberghs
Deakin University

Juan Dominguez
Deakin University

Speakers

Dr Jake Burnett, Cognitive Neuroscience Unit, School of Psychology, Deakin University
White matter microstructure and cognitive performance variability in health and brain injury.

Evelyn Deutscher, Cognitive Neuroscience Unit, School of Psychology, Deakin University
Improving cortical parcellation in ms-TBI: tackling lesion-induced errors with inpainting and standardised quality control.

Dr Juan F Domínguez D, Cognitive Neuroscience Unit, School of Psychology, Deakin University
Detection of brain injuries using portable ultra-lowfield MRI and artificial intelligence in patients with acquired brain injury.

Dr Sarah Hellewell, Perron Institute for Neurological and Translational Science, Curtin University
Neurofeedback as an Intervention for Persisting Postconcussion Symptoms following Mild Traumatic Brain Injury.

Jake Mitchell, Monash University, Department of Neuroscience, School of Translational Medicine
Characterising heterogeneity in brain morphology in traumatic brain injury using normative modelling.

Dr Spencer Roberts, Centre for Sport Research, Institute for Physical Activity and Nutrition Deakin University
Subcortical grey matter volumes in Australian footballers: examining normative deviations, longitudinal changes, and associations with head impact metrics.

COMPUTATIONAL PSYCHIATRY

Friday 28th November @ 11.45am

Monash College (Docklands) | Level 9 | Room 943

Computational psychiatry from theory to clinic.

Computational psychiatry is a field at the intersection of neuroscience, psychology and computational modelling, which employs computational models to characterise the neural and cognitive processes underlying psychiatric conditions. Data-driven and theory-driven computational approaches aim to transform how we conceptualise, diagnose, and treat these disorders. Our symposium brings together a range of expertise in computational psychiatry and we will cover its theory, basic science insights and clinical application. The overarching goal of the symposium is to provide an accessible overview of up-to-date developments in computational psychiatry – including applications in psychiatric populations and animal models. To achieve this, we will present both theoretical and empirical work, including work using data-driven methods, such as machine learning algorithms, and theory-driven generative models. Cross-species work will be presented to demonstrate the translational potential of computational psychiatry approaches. Perspectives from psychiatry will ground these findings in real-world clinical utility, highlighting their potential to advance personalised medicine approaches.

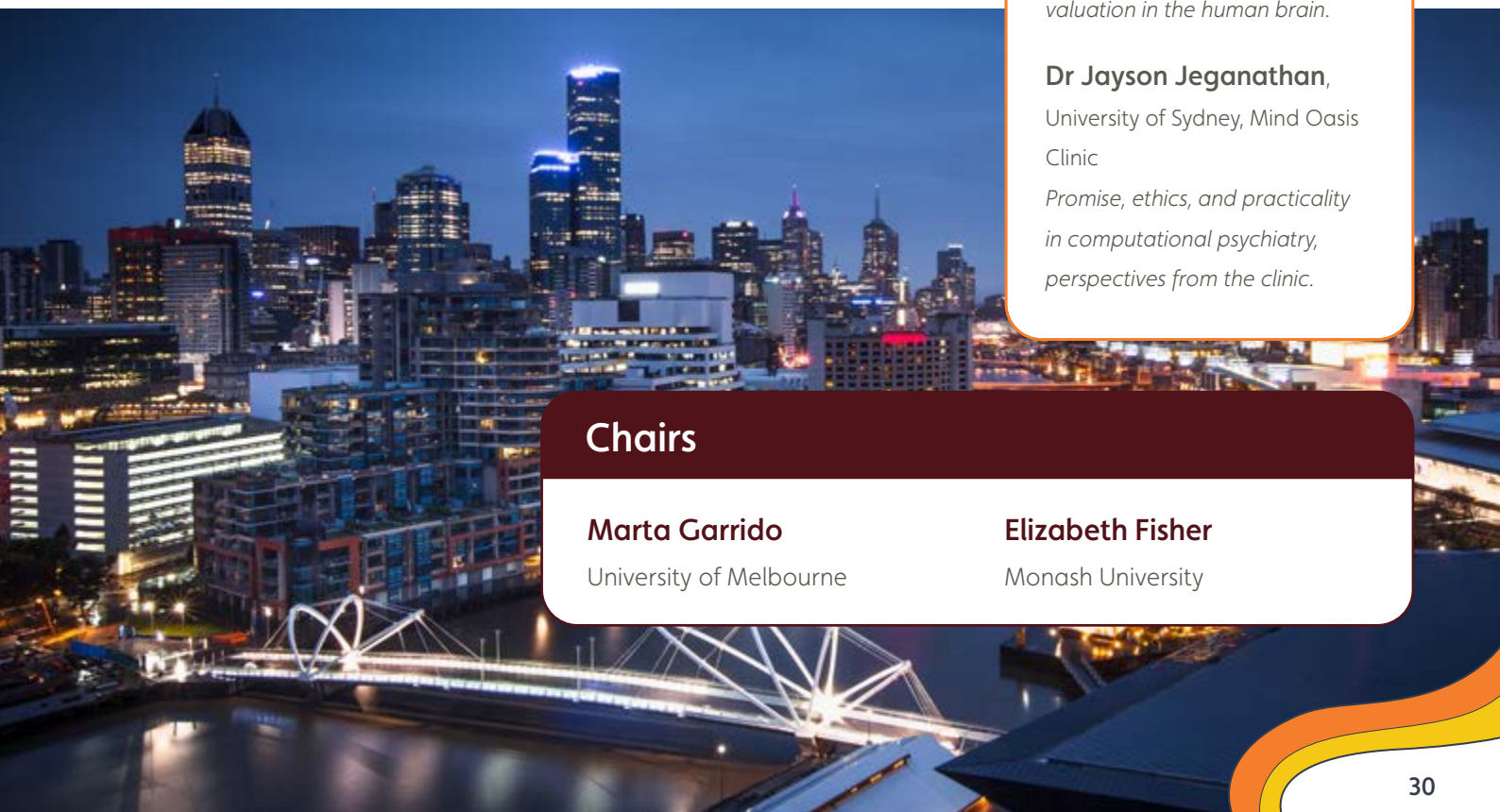
Speakers

Professor Marta Garrido, The University of Melbourne
Computational psychiatry: using mathematical modelling to understand aberrant perception, predict diagnosis, and map brain regions to symptomss.

Dr Elizabeth Fisher, University of Sydney and Monash University
Computational modelling a translational tool.

Dr Huw Jarvis, Monash University
Beyond behaviour: computational modelling of effort and reward valuation in the human brain.

Dr Jayson Jeganathan, University of Sydney, Mind Oasis Clinic
Promise, ethics, and practicality in computational psychiatry, perspectives from the clinic.



Chairs

Marta Garrido
University of Melbourne

Elizabeth Fisher
Monash University

Day 1: Wednesday 26th November

TIME	EVENT			LOCATION
0900-1730	Registration Desk Open			Exhibition Space (Level 2)
0945-1000	Welcome Address			Auditorium (Level 2)
1000-1100	Keynote Address - A/Prof Anne Collins *Plenary proudly sponsored by Monash and Deakin Universities*			Auditorium (Level 2)
1100-1130	Morning Tea			Level 2
1130-1300	Room 943	Room 952	Room 953	Level 9
	Symposium - Motor Learning and Plasticity	Symposium - Computational Modelling of Cognition	Open Talks - Biological Psychiatry	
1300-1400	Lunch			Level 2
1400-1545	Symposium - Curiosity and Creativity	Open Talks - Learning and Decision-Making	Open Talks - Social & Affective Neuroscience	Level 9
1545-1600	Afternoon Tea			Level 9
1600-1730	Fast Talks 1	Fast Talks 2	Fast Talks 3	Level 9
1730+	Welcome Reception			Platform 28

Day 2: Thursday 27th November

TIME	EVENT			LOCATION
0900-1700	Registration Desk Open			Exhibition Space (Level 2)
0900-1030	Poster Session 1 (with Morning Tea)			Exhibition Space (Level 2)
1030-1130	Young Investigator Award - Dr Reuben Rideaux			Auditorium (Level 2)
1145-1300	Room 943	Room 952	Room 953	Level 9
	Symposium - Predictive Processing	Symposium - Development	Open Talks - Dementia	
1300-1400	Lunch			Level 2
1400-1500	Keynote Address - Prof Michael Breakspear *Plenary proudly sponsored by Symbiotics*			Auditorium (Level 2)
1500-1515	Afternoon Tea			Level 2
1515-1700	Symposium - Brain Stimulation	Symposium - Traumatic Brain Injury	Open Talks - Sensation & Perception	Level 9
1900+	Conference Dinner - *Generously sponsored by Monash University and Deakin University*			Taxi Kitchen

Day 3: Friday 28th November

TIME	EVENT			LOCATION
0900-1700	Registration Desk Open			Exhibition Space (Level 2)
0900-1030	Poster Session 2 (with Morning Tea)			Exhibition Space (Level 2)
1030-1130	Emerging Researcher Award - Dr Sophie Smit followed by Sponsor Announcements			Auditorium (Level 2)
1145-1300	Room 943	Room 952	Room 953	Level 9
	Symposium - Computational Psychiatry	Open Talks - EEG Methods	Open Talks - Network Neuroscience	
1300-1400	Lunch			Level 2
1315-1400	Annual General Meeting			Auditorium (Level 2)
1415-1545	Open Talks - Addiction and Compulsion	Open Talks - EEG/MEG and Perception	Open Talks - Motor Cognition	Level 9
1545-1600	Afternoon Tea			Level 9
1600-1700	Open Talks - Lifespan Development	Open Talks - Cognition and Metacognition	Open Talks - 7T MRI	Level 9
1700-1730	Conference Close and Awards			Level 2

Day 1: Wednesday 26th November

TIME	EVENT		
0900-1730	Registration Desk Open (Exhibition Space, Level 2)		
0945-1000	Welcome Address (Auditorium, Level 2)		
1000-1100	Keynote Address: A/Prof Anne Collins - Deconstructing reinforcement learning Chair: Trevor Chong *Plenary proudly sponsored by Monash and Deakin Universities* (Auditorium, Level 2)		
1100-1130	Morning Tea (Level 2)		
1130-1300	**Room 943** Symposium - Motor Learning and Plasticity Chairs: Ann-Maree Vallence & Joshua Hendrikse	**Room 952** Symposium - Computational Modelling of Cognition Chairs: Daniel Bennett & Simon Farrell	**Room 953** Open Talks - Biological Psychiatry Chair: Trang Cao
1130	Neural oscillations in motor skill acquisition in typical and clinical populations Jarrad Lum	Mutual advantage at the interface of cognitive modelling and neuroscience Simon Farrell	Are psychiatric diagnoses associated with a robust neuroanatomical phenotype? Trang Cao
1145	An acute bout of high-intensity cardiovascular exercise facilitates online motor skill learning Emily Brooks & James Coxon	On the formation of routines and their impacts on control: harnessing cognitive neuroscientific insights to build mathematical models of cognition Kelly Garner	Brain associations of affinity scores across the psychosis continuum Warda T Syeda
1200	The effects of repeated exercise priming on motor skill consolidation Joshua Hendrikse	Rethinking representational assumptions in cognitive modelling: implications for cognitive neuroscience Christina Van Heer	Genetic and network-based constraints on gray matter volume changes in psychosis Gabriella Chan
1215	Delivering combined transcranial magnetic and electrical stimulation to induce motor cortex plasticity and improve motor adaptation Jane Tan	A parietal memory-strength signal linked to evidence accumulation in recognition decisions Jie Sun	Ketamine effects on EEG and their links to therapy differ across treatment-resistant major depression, post-traumatic stress disorder, and obsessive-compulsive disorder Shabah M Shadli
1230	Panel discussion	Multivariate classification shows associative learning reduces working memory load William Ngiam	Immunometabolic dysregulation associates with brain atrophy in depression and predates illness onset Ye Ella Tian

1245	Withdrawn	Panel discussion	Personalised transcranial alternating current stimulation for the treatment of depression in young people Efstathia Stephanie Gotsis
1300-1400	Lunch (Level 2)		
1400-1545	Symposium - Curiosity and Creativity Chairs: Gail Robinson & Melody Chan	Open Talks - Learning and Decision-Making Chair: Sarah Tashjian	Open Talks - Social & Affective Neuroscience Chair: Talitha Ford
1400	Neurocomputational mechanisms underlying perceptual and epistemic curiosity Jocelyn Halim	Pain interference in daily life is associated with over-reliance on prior beliefs in judging the pain of others Natalia Egorova-Brumley	Examining the role of brain excitation-inhibition in social processes using functional magnetic resonance spectroscopy (fMRS) Talitha Ford
1415	The neural basis of creative thought: A functional neuroimaging study Melody Chan	Disentangling Bayesian computations versus Bayesian-like heuristic strategies using prior-likelihood metamers Sophie Lin	Treatment-refractory anxiety disorders: Altered activity and connectivity with emotional stimuli Aliesha Kemp
1430	Investigating the role of inhibitory control in creative thought using Transcranial Magnetic Stimulation Eugene Cho	Controlling slips of action: Acquisition and extinction of conditioned tendencies in motor cortex Evan Livesey	No pain, no gain: Interaction of visual competition and motivational ambiguity across face-selective networks Ashley York
1445	Effort-based decision-making: an experimental framework to understand motivation loss in Huntington's and Parkinson's disease Lee-Anne Morris	Adaptive shifts in amygdala-hippocampal theta coupling govern aversive learning and extinction Saurabh Sonkusare	Multibrain decoding reveals complementary neural information during task division Denise Moerel
1500	Creative idea generation in healthy and pathological ageing Gail Robinson	Hippocampal projections predict anxiety during threat extinction in adolescents Sarah M. Tashjian	Positive arousal links positive urgency and choice impulsivity Antoinette Poulton
1515	Panel discussion	A neural correlate of evidence accumulation during dietary decisions Violet Chae	The role of pubertal timing in white matter development and mental health Samuel Berkins Sylas
1530	Panel discussion	Decoding how task information persists in working memory Alexander A. Sulfaro	Impact of puberty age gap on resting-state functional connectivity Soudeh Ashrafipour
1545-1600	Afternoon Tea (Level 9)		
1600-1730	Fast Talks 1 - Clinical Populations Chair: Bridgette Speranza	Fast Talks 2 - Executive Functioning and Methods Chair: James Pang	Fast Talks 3 - Perceptual and Motor Chair: Isabella Goodwin

1600	The importance of temporal proximity of trauma cues in exposure therapy for posttraumatic stress disorder: Evidence from fear conditioning Luke Ney	All proficient foreign language learners resemble native readers, whereas each less proficient learner struggles in their own distinct way Junjie Wu	Perceptual misjudgement and decision-making in traffic interactions with electric mobility devices (EMDs) Ariella Stephen
1607	Can functional coupling predict outcomes following a first episode of psychosis? Isaac Pope	Is the lateralisation of language and visuospatial processing related to language comprehension ability in young children? Josephine Quin-Conroy	Investigating the Globality of GABAergic Inhibition changes in the motor system Yuan Ding
1614	Identifying and predicting trajectories of the sense of coherence in the perinatal period Kelsey Perrykkad	Validation of a Brief Cognitive Task for Assessing Punishment Insensitivity Liz Zeng	Do We Experience Our Entire Perceptual Field as Temporally Bound? Rasmus Pedersen
1621	Tactile discrimination on the abdomen and forearm in pregnancy: a two-point discrimination study Rebecca O'Neill	Tracing the neural trajectories of evidence accumulation processes during voluntary decisions Lauren Fong	Which house, dog, or car is this? A neural and behavioural investigation of visual recognition abilities in Typical- and Super-Recognisers beyond faces Martina Ventura
1628	A Novel Ecological Foraging based Paradigm for Studying Integrated Cognition in Schizophrenia Harsh Arora	Finding the stuff that dreams are made of: Massive feature extraction of NREM EEG data to identify markers of dreaming Vishaal Nair	Systematic underestimation of e-scooter speed relative to other vehicles Blake Jones
1635	Developmental trajectories of brain dysfunction during error processing among adolescents at risk for schizophrenia Ruqayya Dawoodjee	A word in the hand is worth two in the push: Comparing verbal and manual versions of the arrow-word-Stroop task Marlee Wells	Pre-saccadic Mechanisms Support Rapid Face Detection but Are Insensitive to Emotional Expressions Zihe Wei
1642	EEG Markers Vary With Depression Severity Juliet Hosler	Self-reported anxiety and Electroencephalogram measures following single-dose MDMA or psilocybin in healthy volunteers Samantha L Webb	Hybrid images reveal time-dependent neural encoding of competing visual content Almudena Ramirez Haro & Tijl Grootswagers
1649	Cannabidiol Modulates Right Fronto-Parietal Connectivity in Autistic Children: A Secondary EEG Analysis from a Randomised Placebo-Controlled Crossover Trial Nina-Francesca Parrella	Cerebellar stimulation attenuates behavioural impulsivity for reward Alexandra Gaillard	Exercise-induced lactate mediates working memory and neural activity during different training intensities Alicia Goodwill & Lee Yun Xuan
1656	The interaction between stress, schizotypy and the hemispheric lateralisation of language Samantha G. Lane	How the sense of control and predictability affects human stress responses Daniyal Rajput	Time-to-Arrival Judgements and Visual Prediction: How Electric Micro-Mobility Devices Challenge the Human Perceptual System Ella Rose du Plessis

1703	Anodal HD-tDCS for Inhibitory Control in Autism: A Pilot Study Natalia Albein-Urios	Causal role of left pre-SMA and IPC in cognitive flexibility Rajat Joshi	Multiple Simultaneous Representations: Parallel Encoding of Spatial and Non-Spatial Information in Change Detection Cheyanne Gu
1710	Threat Generalization in Adolescence: Perceptual vs. Conceptual Similarity Yubing Zhang	Phase matters most when uncertainty is greatest: Expectancy-dependent modulation of stimulus-driven actions by exogenous slow-oscillatory currents Sam Armstrong	Cognitive modelling reveals impaired processing in older adults during step initiation Sarah Kemp
1717	Resting-state alpha and theta EEG power predict motor imagery ability in children with and without DCD Samaneh Nahravani	Data-driven Mathematical Modelling of Acute Stress Response Kar Fye Alvin Lee	How a toad can illuminate an illusion David Crewther
1730+	Welcome Reception (Platform 28)		

Day 2: Thursday 27th November

TIME	EVENT		
0900-1730	Registration Desk Open (Exhibition Space, Level 2)		
0900-1030	Poster Session 1, with Morning Tea (Exhibition Space, Level 2)		
1030-1130	Young Investigator Award: Dr Reuben Rideaux - Neural design principles for efficient perception across time Chair: Trevor Chong (Auditorium, Level 2)		
1145-1300	**Room 943**	**Room 952**	**Room 953**
	Symposium - Predictive Processing Chairs: Dragan Rangelov & Phuong Dang	Symposium - Development Chairs: Megan Spencer-Smith & Caitlin Hrysanidis	Open Talks - Dementia and Neurodegenerative Disease Chair: Kate Hoy
1145	Concurrent neuro, behavioural, and physiological evidence worse representational fidelity of expected visual events Reuben Rideaux	Working memory strategies in children aged 7 to 10 years Caitlin Hrysanidis	Dissociable effects of education and socioeconomic factors on cognition, the brain, and resilience to dementia Meadhbh Brosnan
1200	Expect the unexpected: What can the observations of 7000 people tell us about the effects of expectation on visual perception? Dragan Rangelov	Exploring the Strategy Mediation hypothesis as a cognitive mechanism of working memory training in children Megan Spencer-Smith	Stimulating connections: Personalised theta-burst stimulation in Alzheimer's Kate Hoy
1215	Differential effects of expectation on perceptual and neural measures of visual object processing Phuong Dang	Behavioural and neural correlates of post-error slowing in the ABCD developmental dataset Iroise Dumontheil	Ethnic differences in Alzheimer's disease blood biomarkers: A systematic review and meta-analysis Xiaoxi Ma
1230	Perception and prediction in psychosis: Preliminary findings from the 'PRIOR' study Elise Rowe	Post-error slowing and adolescent metacognition Kali Chidley	Aperiodic components of resting state EEG in Parkinson's disease and their relationship to mild cognitive impairment Deborah Apthorp
1245	Panel discussion	Panel discussion	Hallucinations in Parkinson's disease and the relationship with structural integrity of the nucleus basalis of Meynert Kyla-Louise Horne
1300-1400	Lunch (Level 2)		

1400-1500	Keynote: Prof Michael Breakspear - Wave-wave interactions between the cortex and hippocampus Chair: Alex Fornito *Plenary proudly sponsored by Symbiotic Devices* (Auditorium, Level 2)		
1500-1515	Afternoon Tea (Level 2)		
1515-1700	Symposium - Brain Stimulation Chairs: Talitha Ford & Aron Hill	Symposium - Traumatic Brain Injury Chairs: Karen Caeyenberghs & Juan F Dominguez D	Open Talks - Sensation and Perception Chair: William Turner
1515	Translating network mapping findings into targets for therapeutic transcranial magnetic stimulation Ellen Younger	White matter microstructure and cognitive performance variability in health and brain injury Jake Burnett	Predictive motion extrapolation requires visual attention Hinze Hogendoorn
1530	Neuromodulation in movement disorders: Using functional connectivity in stimulation targeting Elizabeth Ellis	Improving cortical parcellation in ms-TBI: tackling lesion-induced errors with inpainting and standardised quality control Evelyn Deutscher	Neural tuning to visual motion stimuli depends on the precision of learned priors Tim Gastrell
1545	Efficacy of network mapping-guided continuous theta-burst stimulation in cervical dystonia: A randomised controlled pilot trial Jordan Morrison-Ham	Detection of brain injuries using portable ultra-low-field MRI and artificial intelligence in patients with acquired brain injury Juan Dominguez D	Motion and position illusions: Beyond predictive processing Alex Holcombe
1600	The therapeutic application of repetitive transcranial magnetic stimulation in autism: Findings from a randomised controlled trial Briella Rodriguez	Neurofeedback as an intervention for persisting post-concussion symptoms following mild Traumatic Brain Injury Sarah Hellewell	How does motion context affect multisensory integration of audiovisual stimuli? Chloe Langbein
1615	The neurophysiological effects of theta burst stimulation as measured by electroencephalography: A systematic review Bridgette Sperenza	Characterising heterogeneity in brain morphology in traumatic brain injury using normative modelling Jake Mitchell	From spikes to symptoms: Simulating SC driven multisensory deficits in ASD Vishnu Mohan
1630	The 'Big NIBS data' project: The world's first open-source data sharing repository for non- invasive brain stimulation data Michael Barham	Subcortical grey matter volumes in Australian footballers: examining normative deviations, longitudinal changes, and associations with head impact metrics Spencer Roberts	Probing circuit-level integration of language content and probability during continuous speech understanding William Turner
1645	Panel Discussion	Panel Discussion	
1900+	Conference Dinner Generously sponsored by Monash and Deakin Universities (Taxi)		

Poster Session 1 - Thursday 27th November, 0900-1030

POSTER BOARD	NAME	TITLE
1	Gezelle Dali	Trajectories of Delay Discounting and Smoking from Adolescence to Young Adulthood
2	Andrea Phillipou	Neurotransmitter Concentrations in Anorexia Nervosa
3	Nicole Stuart	Distinct Neurocognitive Signatures for Inattention, Hyperactivity-Impulsivity, and Cognitive Disengagement Syndrome: A Meta-Analytic Investigation
4	Michele Garagnani	The Relevance of Oxygen for Decision Making
5	Olivia Maurice	Age-dependent effects of multilingual experience on executive and metacognitive functioning: Evidence from Generalised Additive Modelling
6	Shawn Prest	Is affective valence really only about uncertainty reduction? How meditative experience challenges prevailing computational accounts of affect
7	Sanaa Khosla	Dopaminergic and Cholinergic Alterations in the Hippocampus and Prefrontal Cortex of MPTP-Treated Marmosets: An Immunohistochemical Study
8	Lin Lipeng	Do I experience happiness in the same way as you do? A relational approach to characterize emotional experience
9	Mostofa Jamal	COA-Cl restores dopamine loss in the striatum of the MPTP-induced Parkinson's disease mouse model
10	Katia Manariti	Developing the Lifetime Engagement in the Activities of Parenthood (LEAP) Scale: Capturing Environmental Complexity in Caregiving Across the Lifespan.
11	Ssuting Chen	Global vs. local feature processing in early visual stages: evidence from N1 and vMMN
12	Farshad Alizadeh Mansouri	Investigating 'where', 'when', and 'how' direct current stimulation modulates information encoding by prefrontal neurons, to lead to the changes in cognitive functions.
13	Chunlin Liu	How explicit and implicit feedback shape L2 learners' anxiety in real-time communication:An fMRI study
14	Angus Leung	Testing the prevalent consistency assumption of (un)conscious processing through massive feature extraction of inattentional blindness EEG
15	Christopher Buckland	The Impact of Target Genuineness and Participant Task on the Speed of Face Detection
16	Francesco Ellia	Intrinsic Universal Structures and Extrinsic Local Functions
17	Ellen Christy	Investigating Perruchet's dissociation between performance and expectancies in the flanker task
18	Philippe Chouinard	The role of visual awareness and specific phobias in physiological reactions to evolutionary threatening animals
19	Benjamin G. Lowe	Position representations of predictably moving visual objects are unaffected by spontaneous lapses in sustained attention
20	Kaila Bianco	OSCILLATE: A large-scale cohort study in Deakin's Cognitive Neuroscience Unit
21	Yessenia Rivera	Gallery Glimpse: A naturalistic video game task to test neural mechanisms of memory development
22	Keri Justice	Sleep quality differentially moderates peripheral and central hearing effects on cognitive performance in older adults
23	Helena Canals Fiol	If the doors of self were cleansed: Effective connectivity of ego dissolution
24	Janneke Lemmerzaal	Cortical thickness changes during development in attention deficit hyperactivity disorder remission and persistence
25	Pablo Franco	Measuring the computational complexity of optimal choice via Fitness Landscape Analysis
26	Caleb Stone	Decoding distraction: An EEG study of value-modulated attentional capture
27	Max Hill	Cue-Based Modulation and Transfer of Cognitive Control Across Conflict Tasks
28	Cameron Bell	Exposure to nature scenes improves the efficiency of inhibitory control in a conflict monitoring task
29	Emily Coleman	The effects of rewards and punishments on action execution and inhibition

30	Jacob Thorstensen	A mental math stress task increases motor cortical and spinal motoneuronal excitability
31	Reece Nowell	Effect of retroactive interference on micro-consolidation of a visuomotor sequence
32	Florian Burger	Temporal Mapping of Neural Processing Stages via Model-optimised Stimulus Selection
33	Milly Li	The application of neurofeedback to stress and trauma: A systematic review and meta-analysis
34	Milena Spoa	Resting-State Quantitative EEG Changes Associated with Cognitive Decline in ParkinsonV¢‚Ç¨¨‚Ñ¢s Disease: A Systematic Review
35	Anthony J. Lambert	Anauralia & aphantasia: Prevalence and distinct associations with personality, well-being and self-regulation in a large, representative sample.
36	Nermin Aljehany	Investigating the role of beta oscillations in the rapid consolidation of implicit motor sequences
37	Gemma Perry	Neural Correlates of Chanting: A Systematic Review
38	Madeleine Homes-Vickers	Changing the game: the impact of serious games based cognitive training on cognitive function in Parkinson's disease
39	Devon Stoliker	PsiConnect: Context-Dependent Brain Dynamics under Psilocybin
40	Thomas Haslam	Modulating Metacognition: How Attentional Demands and Task Complexity Shape Confidence Judgements in Perceptual Decision-Making
41	André Botes	Assessing the Representation of Goals in Value-Based Decision-Making: An EEG study
42	Ashley L. M. Platt	Individual-level contextual alignment and aperiodic slope reveal improved comprehension of unexpected language
43	Teo Wei Peng	The Impact of Competition and Awareness Tools on Emotion, Cognitive Load, and Functional Connectivity in Digital Game-Based Learning
44	Kevin Walsh	The neuropharmacology of perceptual decision-making
45	Anna Fioretti	Can we just ignore it? The effect of phone-like vibration distractions on sustained attention in a dynamic task
46	Zakia Z Haque	Investigating the interaction of transcranial stimulation of prefrontal cortex with contextual factors in modulating response execution and action inhibition
47	Robin Laycock	Fixations on the speaker in dyadic social interactions predict social competencies
48	Vismay Agrawal	A Formal Computational Model of Suffering and Meditative Progress
49	Jasmin Patel	Occluded objects: more than meets the eye? Differentiating between anticipatory location representations and signals of object permanence.
50	Katharina V. Wellstein	Estimation of Uncertainty of Socio-Affective Stimuli in Individuals with Constricted Affect
51	Aastha Sarraf	Systematic review and meta-analysis of the development of post-error slowing in typically developing children and adolescents
52	Radietya Alvarabie	Exploring Neuroplastic and Functional Outcomes of a Virtual Sailing Intervention for Major Depression: A Study Protocol
53	Anton Sidorov	Exploring the structure of synaesthetic colours
54	Mary Mandile	Testing for expectation suppression in auditory predictive cueing designs using multivariate pattern analyses and electroencephalography
55	Leila Nategh	Tracing Cognitive Strategy: Eye-Tracking Evidence of Executive Load in Symbol Digit Modalities and Trail Making Test Performance
56	Adam Batten	A simulation toolbox for benchmarking unshielded MEG
57	Melanie J. Murphy	Critical Flicker Fusion Threshold, Information Processing Speed, and Eye-Movement Efficiency as Predictors of Healthy Cognitive Aging

Day 3: Friday 28th November

TIME	EVENT		
0900-1730	Registration Desk Open (Exhibition Space, Level 2)		
0900-1030	Poster Session 2, with Morning Tea (Exhibition Space, Level 2)		
1030-1130	Emerging Researcher Award: Dr Sophie Smit - When seeing becomes feeling: Understanding vicarious experience in the brain Chair: Talitha Ford Sponsor Announcements (Auditorium, Level 2)		
1145-1300	**Room 943**	**Room 952**	**Room 953**
	Symposium - Computational Psychiatry Chairs: Marta Garrido & Elizabeth Fisher	Open Talks - EEG Methods Chair: Thomas Whitford	Open Talks - Network Neuroscience Chair: Stuart Oldham
1145	Computational psychiatry: using mathematical modelling to understand aberrant perception, predict diagnosis, and map brain regions to symptoms Marta Garrido	Long-term reliability of parameterized resting state EEG: Evidence from a five-year follow-up Douglas Angus	A geometric resonance model of the mammalian connectome Francis Normand
1200	Computational modelling a translational tool Elizabeth Fisher	Developing an EEG-based biomarker of inner speech Thomas Whitford	Only a matter of time: Developmental heterochronicity captures properties of the human connectome Stuart Oldham
1215	Beyond behaviour: computational modelling of effort and reward valuation in the human brain Huw Jarvis	Independent component subtraction distorts the neural signal in electroencephalography data, so targeted artifact reduction is better Neil Bailey	Investigating the spatiotemporal profile of consciousness using Dynamic Causal Modelling Kavindu Bandara
1230	Promise, ethics, and practicality in computational psychiatry, perspectives from the clinic Jayson Jeganathan	Considerations when transferring EEG sound sequences into fMRI Mattsen Yeark	Constraints on mouse brain function and organisation Mehul Gajwani
1245	Panel discussion	Characterising excitation and inhibition with TMS-evoked EEG potentials from prefrontal and parietal cortex: a pharmacological study with carbamazepine and diazepam Wei-Yeh Liao	The moment-to-moment variability of cerebral glucose use shapes the network efficiency and information processing capacity of the brain Hamish Deery & Sharna Jamadar
1300-1400	Lunch (Level 2)		

1315-1400	Annual General Meeting (Auditorium, Level 2)		
1415-1545	Open Talks - Addiction and Compulsion Chair: Emily Colton	Open Talks - EEG/MEG and Perception Chair: Anthony Harris	Open Talks - Motor Cognition Chair: James Coxon
1415	Leveraging resting-state fMRI to characterise neural network alterations underpinning craving in alcohol use disorder Antonio Verdejo-Garcia	Alpha oscillations in visual cortex produce anti-Bayesian perceptual biases Henry Beale	Generalisation between motor and episodic sequences: A conceptual replication of Mosha & Robertson (2016) Sophie Thong
1430	Can a brief mindfulness intervention reduce resting state functional connectivity alterations in cannabis use disorder? A double-blind fMRI trial Hannah Thomson	Alpha oscillations rhythmically modulate the spatial precision of vision Anthony Harris	Interactions between stimulus congruence and expectancy challenge two-stage models of action cancellation Mark Hinder
1445	Recreational substance use and neurodevelopment: findings from multimodal longitudinal consortia Valentina Lorenzetti	It's all in the alpha: Using MEG to investigate the temporal decoding of simple visual features during visual imagery Rebecca Keogh	Stopping to change: Rethinking the dynamics of inhibition Alison Ross
1500	Disentangling white matter alterations across psychotic-like experiences, early psychosis and cannabis use disorder: A Fixel-Based Analysis approach Isabella Goodwin	Revealing rhythm categorization in human brain activity Tomas Lenc	Motor attenuation in schizotypy Dominic Tran
1515	Lisdexamfetamine Dimesylate (LDX) pharmacotherapy for Binge Eating Disorder is associated with behavioural and neurocognitive changes during Pavlovian-to-Instrumental Transfer Emily Colton	The dynamics of ambiguous image recognition charted with magnetoencephalography Erin Goddard	Plasticity in grey and white matter following transcranial ultrasound stimulation James Coxon
1530	Probing the craving neurocircuitry in Cannabis Use Disorder using real-time fMRI neurofeedback Amir Dakhili	Limited evidence for expectation suppression in auditory predictive cueing designs as assessed using event-related potentials Jason Fung	Withdrawn
1545-1600	Afternoon Tea (Level 9)		
1600-1700	Open Talks - Lifespan Development Chair: Karlo Doroc	Open Talks - Cognition and Metacognition Chair: Yohan Wards	Open Talks - 7T MRI Chair: Jacob Paul
1600	Software and hardware: Cognitive reserve and brain structure underlie cognitive heterogeneity in Parkinson's Disease Isaac Saywell	Phase similarity between similar objects indicates representational merging across retrieval training but not sleep Hayley Caldwell	Ultra-fast 7T fMRI gives new insight into hemispheric communication in visual perception Amanda Robinson

1615	MRI-based prediction of cognitive functioning: Unpacking between-individual differences and longitudinal change Kseniia Konopkina	Causal neural substrates of task-switching and metacognition Joshua Sabio	Does altered motor function reshape the adult body map? An ultra-high-field fMRI study of Motor Neuron Disease Harrier Dempsey-Jones
1630	Is this healthy ageing or Parkinson's disease? Examining the known-groups validity of a large cognitive and motor assessment battery Brittany Child	Distinct GABA and network signatures underlie individual differences in metacognitive profiles Yohan Wards	Resting-state GABA and glutamate concentrations are correlated across brain areas involved in executive function: Evidence from 7T magnetic resonance spectroscopy Alvin Wong
1645	Healthy cognitive ageing is associated with reduced decision-making capacity Karlo Doroc	Cultivating scientific humility: A brief metacognitive intervention to combat my-side bias and misinformation susceptibility Leigh Grant	Interaction between retinotopic and numerotopic field maps in parietal cortex with 7T fMRI Jacob Paul
1700-1730	Conference Close and Awards (Auditorium, Level 2)		

Poster Session 2 - Friday 28th November, 0900-1030

POSTER BOARD	NAME	TITLE
1	Kyoko Kusano	Measuring the Diversity of Qualia: A Category-Theoretic Approach to Psychophysical Experimental Data
2	Zhang Chuyin	Intersubjective agreement reduces friction between report and visual experience
3	Oliver Baumann	Environmental Context Modulates Neural and Affective Responses to Meditative Chanting
4	Georgia F. Caruana	Exploring blood-based biological correlates of cognitive intra-individual variability and other cognitive measures in bipolar disorder
5	Rui Zheng	Structure-metabolism coupling in healthy aging: a multimodal brain network analysis
6	Annalise May Leopold	Examining the neural and experiential basis of Tourette syndrome: A protocol
7	Jade-Jocelyne Zouki	Comparison of neural networks for Tourette syndrome and related disorders: a network mapping approach
8	Abdullah Al Sattar	Ketamine's Neural Signatures in Treatment-Resistant Depression and PTSD: A Resting-State EEG Study
9	Lyndon Firman-Sadler	Age and sex differences in neuro-psychometric networks of cognition, emotion and brain structure
10	Daniel McKeown	Acute exposure to hypoxia impairs navigational ability and slows alpha and beta EEG activity but not aperiodic EEG activity.
11	Mohammed Alghamdi	Contribution of Cerebral Small Vessel Disease and Plasma Biomarkers to Default Mode Network Functional Failure along the Alzheimer's Disease Continuum
12	Kana Matsuyanagi	Is my favorite colour your favorite colour?
13	Thomas Carlson	Serial Dependence in Consumer Decision Making
14	Hedwig Eisenbarth	Emotional content distracts us from (boring) tasks - but not those high on psychopathy
15	Greta Simpson	To Approach or Avoid? Perceptual Similarity Judgements Reveal That We Encode Pain Faces As Negative Emotions
16	Anson So	Does culture shape our perception? A comparative study on Japanese mora perception between Japanese and English speakers
17	James Donohoe	Testing Critical Assumptions of Attention Restoration Theory: Subjective Scope in Nature Images Predicts Cognitive Performance
18	Dalia Israel	The influence of stimulus exposure duration on deepfake detection accuracy
19	Dr Gemma Lamp	Optimizing the clinical effectiveness of TBS treatment of depression (OPTI-TBS): A clinical randomised controlled trial
20	Margaret Jane Moore	Assessing the utility of neuroimaging and behavioural biomarkers of post-stroke cognitive recovery outcomes
21	Tianjian (Mike) Jiao	Can the quantum approach apply to conscious perceptual judgement?
22	Steven Phillips	Sheaf networks for the cognitive neuroscience of information binding
23	Gyu Hwan Park	Lithium chloride enhances memory and neuronal survival through Nrf2 signaling in Alzheimer disease model mice
24	Rose Mery Bou Merhy	Combining cognitive training and intermittent theta burst stimulation to improve cognition in mild cognitive impairment: A pilot randomised controlled trial
25	Louise Inger	A novel saccade-based spatial working memory task in marmoset monkeys
26	Clara Tan Xinru	Exploring the nexus of lifestyle, education, and social factors: A systematic review of cognitive resilience via biomarkers
27	Britt Burton	Exploring rural-urban differences in modifiable dementia risk factors and cognitive performance in older Australians
28	Simon Weber	Has Stopping Stopped Making Sense? A Critical Interpretation of Complex Action Cancellation Paradigms

29	Timothy Cottier	A novel odd-one-out task reveals super-recognisers spontaneously and preferentially process face-identity information
30	Bryan Paton	Exploring models of learning and action: the Generalised Hierarchical Gaussian Filter
31	Jasmine Burrows	From exposure to impact: Measuring the cognitive effects of trauma in the general population
32	Mei-Yee Mavis Ho	CHARM-DiGiTAL: Protocol for a personalized digital intervention to improve cognitive outcomes in midlife
33	Louisa Selvadurai	Tracking the Cerebellar Cognitive Affective Syndrome: Two-year decline in cognitive performance in spinocerebellar ataxias
34	Xindong Zhang	The neural basis of lexical tone in bilingual language processing
35	Zhou Yu	Emotion processing in the periphery under suboptimal viewing conditions: An electroencephalography study using a face-crowding paradigm
36	Sarah Moran	Tracing the attentional spotlight: Investigating alpha oscillations during a continuous monitoring task
37	Matthew O'Donohue	Characterising recognition memory for novel cross-modal associations
38	Josef J. Ormsby	Hemispheric Asymmetries in Emotional Face Processing: An EEG MVPA Study
39	Matthew Crossley	Memory masking vs overwriting in procedural categorisation
40	Pauline Frey	Stacking the odds: Exploring a block-stacking virtual reality task as a more engaging alternative to the balloon analogue risk task
41	Yige Zou	Stimulus Orientation Extrapolation Arises Via Shifted Population Responses in the Visual System
42	Bashirah Basri	Neural correlates of realistic face processing in adults with autistic and ADHD traits: An fNIRS study
43	Rebecca Healey	Thinking on your feet: Perceptual and motor inhibition during step initiation in young and older adults
44	Mahdiyeh Khanbagi	Decoding Neural Responses to Partly Occluded Objects in 6-Month-Old Infants
45	Hannah Keage	Predicting delirium vulnerability from pre-surgery neurophysiological measures: A protocol for the DIVULGE 2 study
46	Emily Chung	Learning transfer is hindered by stable contexts and the formation of routines during practice
47	Catherine Kelly	Post-acute changes in cognition following psychedelic treatment: A systematic review of clinical and preclinical evidence
48	Yilin Wu	Smooth movements are slow but not necessarily accurate
49	Solange Glasser	Synaesthete musicians: insights at the intersection of psychology, neuroscience, and artistic practice
50	Zinia Chan	An empirical and immersive interpretation into lived synesthetic experiences of musicians
51	Adrian Herbert	The neural and behavioural markers of visual hallucinations in age-related macular degeneration
52	Victor Barnes	Regional heterogeneity shapes large-scale wave dynamics in the mammalian cortex
53	Bradley N. Jack	Inner speech and the slow negative wave: Disentangling preparation and anticipation
54	Judy Li	Investigating the fractional occupancy of brain states during an emotionally salient video in psychosis using hidden Markov modelling - preregistration
55	Mengting Zhang	A Unified Account of Cognitive Control Within the Active Inference Framework
56	Sarah Podwinski	The development of strategic intention-offloading during childhood
57	Brian M Ignacio	Migraine: Attention, Processing Speed and Cognition
58	Erfan Rezaei	Neuronal correlates of tactile decision-making in humans
59	Zoe Lee-Youngzie	Integration of texture information from visual and verbal cues depends on cross-modal distance in humans, but not in MLLM
60	Najwa-Joelle Metri	Targeting cognitive, affective, and neurophysiological changes during the menopause transition using intermittent theta-burst stimulation: a pilot clinical trial protocol
61	Mugdha Mukherjee	White matter fibre correlates of atypical motor imagery performance in children with developmental coordination disorder

EEG-ECeG coherence mapping of human cerebro-cerebellar projections

Neil PM Todd, Department of Psychology, University of Exeter

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The cerebellar and cerebral cortices are powerfully connected via reciprocal, crossed projections which mediate their coordination in motor, cognitive and affective processes. In the present paper we demonstrate non-invasive imaging of crossed cerebro-cerebellar connectivity by means of the imaginary component of the wavelet cross-spectrum. In a sample of six healthy adult subjects, we recorded EEG and the electro-cerebellogram (ECeG) with a 10% cerebellar extension montage during voluntary left and right index finger and foot movements. EMG was also recorded from finger extensors and flexors and from the tibialis anterior and soleus muscles and was used to generate triggers for movement related averaging (-2000 to + 2000 ms). Consistent with prior observations of movement related changes in delta/theta power, we observed significant movement related change in the delta-band EEG-ECeG Im-cross-spectrum. Of particular note, when lateralised seeds were selected (F1 vs F2 and SO11 vs SO12, see Figure) the low-frequency Im-cross- spectrum was distributed contralaterally and frontally for cerebellar seeds, likely reflecting the underlying crossed cerebro-cerebellar projections, as well the cerebral contralateral somatosensory representation. For the F1/F2 seeds the movement related change in the delta-band EEG-ECeG Im-cross-spectrum was more bilateral but with right-hemisphere dominance. The cerebral frontally seeded Im-cross-spectrum further demonstrated strong cortico-cortical delta/theta coherence with bilateral posterior parietal and temporal cortex, as well as alpha/beta coherence with primary sensory-motor cortex for the hands. These findings further support the value of recording cerebellar ECeG and demonstrate its potential to contribute to the understanding of cerebro-cerebellar function and dysfunction.

Data-driven Mathematical Modelling of Acute Stress Response

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Recent advancements in computational power have led to the success of using multimodal physiological measures to predict acute stress through “black box” models. However, developing an interpretable model is imperative in understanding the complex brain-body interplay during acute stress. To this end, we collected a diverse range of electrophysiological data (i.e., electroencephalography, electrocardiography, electrodermal activity, and impedance pneumogram) while experimentally inducing stress in 100 participants (Mage = 24.42; SDage = 5.01). Leveraging symbolic regression, optimised through a genetic algorithm, we uncovered a mathematical representation, where Stress State = Correlation Dimension of Heart Rate Variability / Inspiration Duration – (0.001 * NN Histogram Triangular Interpolation) – F8 Beta + T4 Theta / F7 Theta + T3 Beta, with a test accuracy of 87% in predicting acute stress state. Given that inspiration duration emerged as one of the key features. A follow-up experiment using deep breathing intervention was found to be effective in increasing inspiration duration and, consequently, reducing perceived stress levels as compared to control. Causal discovery analysis further revealed complex and intricate stress-related changes in the brain-body dynamics amongst these features. Specifically, there was greater interhemispheric and interlobe directional connectivity during acute stress. In addition, there were more top-down regulatory influences from the frontotemporal neural regions on the autonomic nervous system during acute stress. Overall, our hybridised approach bridges the gap between traditional experimental research and modern-day black box models, offering interpretable insights into the complex stress-related brain-body dynamics and identifying potential targets for precision intervention.

Targeting cognitive, affective, and neurophysiological changes during the menopause transition using intermittent theta-burst stimulation: a pilot clinical trial protocol

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Background: Cognitive complaints such as memory lapses and reduced attention are frequently reported during the menopause transition, affecting up to 70% of midlife females. These symptoms are believed to stem from hormone-driven alterations in brain structure, connectivity, and metabolism, particularly within prefrontal-limbic networks. Despite their prevalence and impact, targeted interventions remain scarce.

Methodology: This double-blind, randomised, sham-controlled pilot trial investigates the neurophysiological and cognitive effects of intermittent theta-burst stimulation (iTBS) applied to the left dorsolateral prefrontal cortex (DLPFC) in females undergoing the late menopause transition. Participants will receive either active or sham iTBS for five consecutive sessions over one week. Stimulation parameters follow standard iTBS protocols (600 pulses/session, 80% resting motor threshold). Primary outcomes include: (a) resting state cortical oscillatory and non-oscillatory activity quantified with EEG; and (b) intracortical inhibitory paradigms (paired-pulse TMS, short- and long- interval intracortical inhibition). Secondary outcomes assess subjective cognitive complaints and performance on a neuropsychological battery targeting verbal memory, executive function, processing speed, and sustained attention. Exploratory tertiary outcomes include mood, sleep quality, heart rate variability, and neuroimmune markers from saliva and urine.

Discussion: This study is the first to evaluate the mechanistic and cognitive effects of iTBS in females transitioning from perimenopause to menopause. Findings will inform neural targets, effect sizes, and feasibility for larger trials aimed at supporting cognitive health during midlife in females.

Integration of texture information from visual and verbal cues depends on cross-modal distance in humans, but not in MLLM

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A growing body of work suggests that perceptual experience is a result of interactions between low-level sensory and higher-level cognitive processes. For example, semantic knowledge activated by language has been shown to modulate phenomena once considered purely perceptual, such as stimulus detection and discrimination. However, the conditions under which language affects perception of non-linguistic material remain unclear

In this study, we test the hypothesis that the influence of semantic knowledge on perceptual judgments depends on the structural distance between cross-modal cues within a shared representational space. We focus on material perception, comparing human judgments with those of a multimodal large language model, whose encoding of visual input is anchored in semantic embeddings. Human participants and the model made material property judgments (e.g., fluffy) given a material presented as an image, a word, or a combination of both.

Results revealed a significant divergence in how humans and the model integrate visual and verbal information. Human judgments of combined cues were modulated by cross-modal distance: when visual and verbal representations were closer in the common space, judgments reflected contributions from both cues, whereas the verbal cue dominated when they were farther apart. By contrast, the model relied on the verbal cue regardless of cross- modal distance. Notably, this difference persisted even when behavioral judgments were comparable.

These findings provide preliminary evidence for a distance-based integration of semantic and sensory information across modality-specific representational structures, a strategy fundamentally different from that of current multimodal language models.

Critical Flicker Fusion Threshold, Information Processing Speed, and Eye-Movement Efficiency as Predictors of Healthy Cognitive Aging

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Ageing is associated with memory difficulties, slower learning, and increased dementia risk, yet the characteristics of 'typical' cognitive ageing remain unclear. As human attention and cognition are largely driven by the visual system, this study examined associations between critical flicker fusion thresholds (CFFT; as a measure of subcortical pathway processing), inspection time (IT) for familiar objects (measuring ventral pathway exposure time), and visuo-verbal processing efficiency measured via a Rapid Automatic Naming (RAN) eye- tracking task in healthy adults. Forty participants aged 19–79 completed a demographic survey, vision and IQ screening, followed by CFF and IT, and RAN tasks. Bayesian correlations and regressions assessed associations between age, FF, IT, and eye-tracking measures. Results showed strong evidence for age-related declines in FF (subcortical processing) and IT (ventral pathway efficiency), whereas eye-tracking metrics showed minimal association with age. Bayesian regressions identified FF and IT as the strongest predictors of age-related visual decline, followed by models incorporating fixation efficiency and saccade duration. This study demonstrates evidence that CFFT and information processing speed is reduced with age, contributing to declines in visual system function, which may be associated with altered Magnocellular pathway function. Eye-tracking measures showed minimal associations with age. Establishing the profile of 'normal' age- related changes is critical for distinguishing typical cognitive and sensory ageing from disease-altered function. Future research should integrate advanced visual assessments, multisensory approaches, and consider emotional and lifestyle influences to refine understanding of normative ageing trajectories underpinned by altered metabolic and neurobiological profiles across the lifespan.

Neuronal correlates of tactile decision-making in humans

Erfan Rezaei, Monash University

Mehdi Adibi, Monash University

Mark Bellgrove, Monash University

Tactile motion is a fundamental perceptual experience, yet the neural processes supporting motion decisions in touch remain poorly characterised. In particular, it is unclear how sequential tactile evidence is accumulated to guide directional judgements. We developed a vibration-based motion paradigm in which pairs of 100 Hz amplitude-modulated vibrations (0.5 Hz) were delivered to two fingertips. Phase offsets between envelopes generated leftward or rightward apparent motion, enabling systematic variation of motion evidence.

We examined whether (i) hand configuration (unimanual vs bimanual, n = 22) and (ii) task difficulty within bimanual trials (n = 16) modulated behavioural performance and central decision-related activity measured over centro-parietal electrodes (POz/Pz). EEG was recorded from 64 channels, and signals were quantified response-locked with a pre- response baseline (–1200 to –1100 ms). <you may cut this if needed for word count> Bimanual stimulation produced a modest but reliable gain in accuracy (+7.8%) relative to unimanual stimulation, accompanied by larger central responses (peak +16.9%, slope +21.7%). Within bimanual trials, difficulty was manipulated across three levels: easy (90° phase offset, accuracy =96%), hard (phase offset estimated with QUEST; mean offset = 15°, yielding 76% accuracy), and no-motion (0°). Behaviour scaled robustly with difficulty (easy > hard), with differences reflected in graded central response dynamics (easy > hard).

Together, the results show that tactile motion decisions engage CPP-like central activity that reflects evidence accumulation, bridging behavioural performance with neural dynamics and extending perceptual decision-making models to the tactile domain.

No Pain, No Gain: Interaction of Visual Competition and Motivational Ambiguity Across Face-Selective Networks Authors

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Faces are fundamental social signals, and in everyday vision they are rarely seen alone. Instead, we typically encounter them embedded within scenes and alongside other visual information. Recent ultra-high-field fMRI shows that this context matters. When faces are viewed with competing scene content, response patterns in the fusiform face area (FFA) vary by hemisphere. The left-FFA preserves a contralateral bias for peripheral faces, whereas the right-FFA loses this bias. Comparable asymmetries are not observed for object- selective cortex, suggesting that the lateralised sampling of visual space is a distinctive feature of face processing that becomes evident only under more naturalistic viewing conditions.

The fact that lateralisation emerges only under more naturalistic viewing suggests that emotional faces, which carry their own lateralisation signatures, may provide a critical test of this phenomenon. Motivational accounts link hemispheric asymmetries to action tendencies, with approach-related signals such as happiness favouring the left hemisphere and avoidance-related signals such as fear and disgust favouring the right. Pain expressions are theoretically critical because they can signal both threat and vulnerability, making them an ideal probe of how competition-dependent lateralisation interacts with emotion- contingent networks. Beyond the ventral stream, the posterior superior temporal sulcus, a region central to decoding emotional facial cues, may reveal complementary and potentially right-lateralised mechanisms for prioritising expressions under competition.

Using 7T fMRI in thirty-six adults, we reprised this paradigm with systematic modulation of facial emotion type (happy, neutral, pain). ROIs across ventral visual and affective networks tested how competition and expression interact under naturalistic viewing.

Migraine: Attention, Processing Speed and Cognition

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Migraine is one of the most prevalent neurological conditions worldwide and while most research and treatment strategies focus on symptom relief and headache mitigation, less attention has been given to the neurological and cognitive impacts of migraine in the headache-free interictal phase. Given the predominance of visual symptoms in migraine, we hypothesised that temporal differences in critical flicker fusion thresholds, processing speed, eye movements and multifocal Visual Evoked Potentials (mfVEPs) would be observed between migraineurs compared to non-migraineur controls, which are indicative of altered magnocellular and parvocellular visual pathway function and neural efficiency. Thus, this pilot study investigated whether migraineurs during the interictal phase showed differences in visual attention, reaction time, eye movements, visuomotor processing speed and mfVEP profiles compared to controls. Demographic information, migraine status, sleep and mood data were also collected. The task battery included the critical flicker fusion threshold, inspection time, change detection, SLURP, and rapid automatic naming (RAN) eye movement tasks, followed by a non-linear analysis of mfVEP recordings. Epoch and latency data were collected, pre-processed in MATLAB, and eye blinks removed. Bayesian analyses were used to determine the evidence for differences in task performance thresholds between migraineurs and controls. Differences in grand mean averages and kernel peak amplitudes (K1, 2.1, 2.2) were analysed for mfVEP data. Our findings provide important behavioural and electrophysiological insights for understanding the nature of altered visual and neural processing in migraineurs during the interictal phase of migraine.

A simulation toolbox for benchmarking unshielded MEG

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Magnetoencephalography (MEG) is a powerful and minimally invasive tool for imaging neuronal activity, with applications from diagnosis of neurological conditions through to research into the fundamental operation of the brain.

Existing SQUID-based and OPM MEG systems require the use of magnetically shielded rooms to operate, however emerging alternative magnetometer technology promises MEG at ambient magnetic fields. Operating without a magnetically shielded environment introduces increased noise, and the vector nature of magnetometry accentuates very large changes in signal with head movement.

Here, we present a toolbox to test the feasibility of unshielded MEG which can be used as a testbed for benchmarking of next-generation sensors and development of effective noise removal algorithms. Our approach combines multilevel simulation of neural activity with simulation of multiple sources of noise and artefacts, including changing external magnetic fields and head motion through static and changing magnetic fields. The neural signals and noise sources are propagated to any arbitrary magnetometer sensor space, yielding simulated MEG signals with known ground truth neural sources.

We illustrate the utility of the toolbox with examples that include a variety of different types of simulated neural activity and noise sources, to test both standard and novel noise removal approaches.

How a toad can illuminate an illusion

David Crewther, Swinburne University of Technology

Brightness illusions have puzzled psychophysicists for nearly a century; however, neuroscientific explanations are still few. A compelling brightness illusion arises when a pattern of shaded diamonds moves either left to right or right to left producing a temporal fast-OFF/slow-ON sawtooth pattern resulting in apparent brightening while a fast-ON/slow- OFF sawtooth pattern results in apparent dimming. We had originally used such stimuli in a chick lens-rearing experiment showing differential interference in refractive compensation. When such stimuli were applied in a toad eyecup DC-ERG experiment, we found a clear separation in electrical potential distinguishing fast-OFF from fast-ON sawtooth stimulation. Separate pharmacological blockade of the ON and OFF retinal bipolar

responses and spiking sodium channels (ganglion and amacrine cells) did not eliminate this DC potential separation. Thus, assuming homology across these vertebrate species, the neural locus of the effect is likely to be photoreceptoral or retinal pigment epithelial (RPE) in nature, with a mechanism likely due to the more rapid recovery in RPE cells than photoreceptors after visual stimulation.

The development of strategic intention-offloading during childhood

Sarah Podwinski, The University of Melbourne

Antonina Kirdyashkina, The University of Melbourne

Iroise Dumontheil, The University of Melbourne

Cognitive offloading, the outsourcing of internal information to external resources, is an effective strategy for reducing working memory load and improving task performance. While adults strategically modulate offloading behaviours based on metacognitive evaluations of cognitive ability and task demands, less is known about offloading behaviours in developmental populations. Limited research suggests that strategic offloading emerges in middle childhood, although findings remain inconsistent across studies. Adult neuroimaging research indicates that the emergence of offloading may reflect the maturation of prefrontal networks involved in metacognition, as these networks are engaged during offloading tasks and continue to develop structurally and functionally throughout childhood and adolescence. This ongoing study investigates the emergence of strategic offloading in childhood. Children aged 7-13 years old and adults aged 18-25 years old complete an adapted version of a widely used intention-offloading task, along with measures of verbal and visuospatial working memory and a metacognition questionnaire. Analyses examine age-related differences in offloading behaviour and their relationship with individual and developmental differences in working memory, and self-reported metacognition. Findings will clarify the developmental trajectory of strategic cognitive offloading and lay the groundwork for future research into the neural architecture supporting offloading across development. Understanding the behavioural and neural mechanisms underpinning offloading may inform refinements to instructional pedagogy to foster children's effective use of external aids, particularly in academic contexts, such as mathematics, where cognitive load influences achievement outcomes.

Ethnic differences in Alzheimer's disease blood biomarkers: A systematic review and meta-analysis

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Gurpreet Kaur Hansra, Centre for Healthy Brain Ageing, School of Clinical Medicine, The University of New South Wales

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Blood-based biomarkers have shown potential for early detection and monitoring of Alzheimer's disease (AD), but their performance across ethnic groups remains unclear. Following PRISMA 2020 guidelines, we searched PubMed, Web of Science, and Scopus to August 8, 2025, and identified 138 eligible case-control studies of individuals with AD or mild cognitive impairment (MCI) compared with cognitively unimpaired (CU) participants. Effect sizes were calculated as log ratios of mean blood biomarker concentrations (case vs CU) and pooled using random-effects models. Subgroup analyses were performed to assess biomarker differences across ethnic groups, and meta-regression was used to explore study- level factors contributing to ethnic difference. Meta-analyses showed robust group differences, with the largest effects observed for p-tau217 (AD vs CU: ratio=2.85; MCI vs CU: 1.97), p-tau181 (1.89; 1.42), and GFAP (1.96; 1.47). Compared with White populations, subgroup analyses revealed lower p-tau217 in Asian populations ($p<0.01$), reduced p-tau181 in Asian and Hispanic/Latino populations ($p<0.01$), decreased NfL and GFAP in multi-ethnic cohorts ($p<0.05$), while GFAP was elevated in Asian populations ($p=0.034$) and the Aβ42/Aβ40 ratio in Hispanic/Latinos ($p=0.008$). Meta-regression indicated that differences in p-tau217 between Asian and White populations were largely explained by blood biomarker measurement platforms and country income level, while country income level also accounted for GFAP differences. The use of biomarker-based diagnostic

definitions and age partially contributed to differences in p-tau217, p-tau181, and GFAP, with gender additionally influencing p-tau217. In conclusion, blood-based biomarkers for AD exhibit ethnic differences, highlighting the need for population-specific validation to ensure global applicability.

Phase matters most when uncertainty is greatest: Expectancy-dependent modulation of stimulus-driven actions by exogenous slow-oscillatory currents

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Endogenous slow-rising premotor negativity has long been considered to index voluntary movement preparation. Although often interpreted as motor-specific and goal-directed, converging evidence suggests that premotor activity also reflects fluctuations in slow- frequency brain oscillations. For voluntary stimulus-driven actions, premotor activity is further modulated by temporal expectancy, with increasing negativity when target uncertainty is reduced. Both voluntary self-paced and stimulus-driven movements are influenced by the phase of endogenous slow oscillations, and slow-oscillatory transcranial alternating current stimulation (SO-tACS) over motor regions produces phase-specific effects for self-paced actions. Here we examined SO-tACS phase effects on stimulus-driven actions, and whether these effects are modulated by temporal expectancy. SO-tACS (0.5 Hz,

2 mA) was delivered bilaterally over the primary motor cortex while participants made left/right button-presses to directional targets following short (2.5 s), medium (4.5 s), or long (6.5 s) foreperiods. Targets occurred at eight equidistant timepoints of the 2000 ms SO-tACS cycle. The study was conducted using three independent groups: high expectancy (N = 97; more short foreperiods), neutral expectancy (N = 137; equal short/medium/long), and low expectancy (N = 87; inclusion of target-absent long foreperiods). SO-tACS phase effects were stronger when targets following short foreperiods were least expected, a condition in which motor preparatory activity would be low. Responses to these targets were faster during the cathodal trough than the anodal peak, with the largest difference observed in the low expectancy group. These findings suggest that SO-tACS phase modulates stimulus-driven action in a state-dependent manner, facilitating motor- preparatory dynamics when endogenous premotor negativity is reduced.

Distinct GABA and network signatures underlie individual differences in metacognitive profiles

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Self-regulation of cognition is critical for performance, yet individuals often struggle to accurately assess their own abilities. This lack of metacognitive insight is particularly problematic for attention regulation, as poor monitoring and control of attentional states impedes goal-directed behaviour. Here we examined the neurochemical and network-level correlates of metacognition using ultra-high field magnetic resonance spectroscopy (7T) and resting-state fMRI in a large sample (N = 166). Participants completed the Adult Meta- Attention Knowledge Questionnaire, revealing three distinct profiles: low functioning (low self-rated attention control and monitoring, low strategy knowledge), overconfident (high self-rated attention control and monitoring, low strategy knowledge), and underconfident (low self-rated attention control and monitoring, high strategy knowledge). Prefrontal cortex GABA+

levels differed between groups, with reduced GABA+ in the low functioning cluster, suggesting that inhibitory signalling predicts metacognitive abilities. Functional connectivity analyses revealed selective differences in specific cross-network couplings, but global network architecture failed to distinguish phenotypes. The low functioning group uniquely showed enhanced Default Mode-Salience integration combined with stronger Salience-Visual segregation, potentially reflecting reliance on internal cues when explicit strategy knowledge is limited. While overconfident and underconfident groups were indistinguishable on most connectivity measures, they showed opposing GABA-connectivity relationships. Specifically, higher prefrontal GABA was associated with stronger attention-sensory network coupling in overconfident participants but with weaker coupling in underconfident individuals. These findings reveal that metacognitive phenotypes are associated with distinct patterns of both baseline inhibitory neurochemistry and selective cross-network connectivity, providing foundational evidence linking neurochemical and network-level mechanisms to individual differences in self-awareness and cognitive regulation.

Tracing Cognitive Strategy: Eye-Tracking Evidence of Executive Load in Symbol Digit Modalities and Trail Making Test Performance

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The Symbol Digit Modalities Test (SDMT) and Trail Making Test (TMT) are established measures of processing speed, attention, and executive function. However, traditional scoring based solely on speed and accuracy fails to disentangle the cognitive mechanisms contributing to performance. This study used eye-tracking to investigate the cognitive processes underlying SDMT and TMT performance, with a focus on the role of executive control and working memory.

Fifty healthy adults (mean age = 35.0, SD = 5.3) completed computerized, eye-tracked versions of the SDMT and TMT. Eye-tracking metrics included fixation count, dwell time, key area revisits, and saccadic velocity. Performance on traditional and eye-tracked versions correlated strongly ($r = .70–.76$, $p < .001$), supporting convergent validity. Motor slowing, indexed by peak saccadic velocity, was moderately associated with slower performance ($r = .50$), but perceptual encoding (mean fixation duration) showed no significant relationship.

Critically, high fixation counts and frequent reference key revisits ($r = .71$ and $.76$, respectively) were linked to slower performance, indicating inefficient visual search and limited internalization of stimulus-response mappings, reflecting increased working memory demands. These inefficiencies were most pronounced in TMT-B, where cognitive demands are higher due to alternating set-shifting and sustained goal maintenance. Disorganized search patterns in TMT-B suggest impaired top-down control and weak executive oversight.

These findings highlight the utility of eye-tracking in showing executive and working memory contributions to task performance. In complex tasks, slowed performance is better explained by executive dysfunction than by motor or perceptual limitations alone.

A Unified Account of Cognitive Control Within the Active Inference Framework

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Over the past few decades, several theories have been proposed to explain cognitive control, including conflict-monitoring theory, the dual mechanisms of control (DMC) theory, the expected value of control (EVC) theory, and executive function theory. These theories differ in terminology and structure, raising the question of whether they describe a single construct or heterogeneous processes. This paper examines their core proposals, highlighting connections and divergences. The analysis suggests that cognitive control is multifaceted, and a comprehensive account requires moving beyond individual theories toward integration.

To this end, the paper introduces a generative hierarchical active inference model. It incorporates conflict-monitoring theory by formalizing cognitive control as guiding action away from interference-defined trajectories toward goal-defined ones. In line with EVC theory, the model distinguishes between specifying the direction and the intensity of control. But slightly departing from EVC, this model situates them at different hierarchical levels: direction situated at the lower level, determined by reward; intensity situated at the higher level, determined by net value. Consistent with DMC theory, two control modes are captured. Proactive control corresponds to intensity specification at the higher level, while reactive control corresponds to both direction specification at the lower level and intensity specification. Subcomponents of executive function, such as shifting, updating, and inhibition, are mapped onto computational processes beneath the level of control-direction specification. By integrating insights from existing theories, the model provides a unifying framework for cognitive control and offers stronger explanatory power for the phenomena and underlying mechanisms of various cognitive control dysfunctions.

Language Experience Modulates Pitch Processing: Evidence from a MEG Study

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Pitch is an important acoustic cue in language and music. Since pitch patterns vary across languages, we aimed to investigate how language experience modulates listeners' sensitivity to pitch in this study. We employed an auditory oddball paradigm with MEG recording to compare pitch processing in 21 English monolinguals and 24 Mandarin-English bilinguals. During the task, participants listened to English words as standards, with the same words superimposed with Mandarin tones – either acoustically similar (Tone 2 & Tone 4) or dissimilar (Tone 1 & Tone 3) to English intonation – as deviants. Collapsing across groups, tonal deviations elicited magnetic mismatch field (MMF) responses (deviants vs standards) in bilateral STG, left MTG and left IFG, reflecting basic acoustic processing of deviants during 200-400ms. In the bilateral STG, bilinguals exhibited generally stronger MMFs than English monolinguals, reflecting enhanced pitch sensitivity from their tonal language experience. Notably, in the right STG, English monolinguals displayed greater MMFs to T2 and T4 (vs. T1 and T3), suggesting the assimilation of acoustically similar tones to native intonation patterns. Bilinguals, however, had comparable MMFs to T2/T4 and T1/T3, showing equal sensitivity to all tones. These findings highlight the right STG's role in pitch- pattern processing and suggest that listeners are more sensitive to pitch patterns that are acoustically similar to those in their native language.

Cognitive modelling reveals impaired processing in older adults during step initiation

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In choice stepping tasks, delays in step initiation are linked with more frequent falling. This has been attributed to age-related decision-making delays, declines in sensory and motor neural systems, and more cautious response strategies under uncertain conditions; however, the relative contributions of these factors have proven difficult to disentangle.

In the past few decades, cognitive models have been used extensively to describe human behaviour. These models go beyond standard approaches that use measures of central tendency, instead estimating the latent cognitive processes that likely underly the behavioural outcomes. Yet, their application thus-far been largely limited to standard manual-response tasks.

Here, we present the first application of a cognitive model (the diffusion decision model) for postural control decisions. 54 older (Mage = 70.6 years) and 28 younger (Mage = 29.1 years) adults completed a choice reaction time task, where they responded

to left- or right-facing arrows with either a finger press, seated tap of the foot, or step initiation from standing. We found that the delayed responses in older adults were partly attributable to motor slowing and reduced encoding speed (nondecision time). Additionally, substantial age-related differences emerged in the quality of choice information (drift rates). Taken together, these findings are indicative of impairment in cognitive and sensorimotor processes, rather than changes in strategy. This work demonstrates the value of applying cognitive models to more naturalistic motor behaviours, offering deeper insight into the mechanisms underlying age- related slowing.

Considerations when transferring EEG sound sequences into fMRI

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Event-related potential (ERP) studies using auditory oddball sequences have been especially successful in exploring sensory learning, revealing both how the brain differentiates regularities from deviants and how these processes are altered in clinical conditions such as schizophrenia. However, ERP studies do not have the spatial resolution to show exactly where these differences occur. An attractive complement is fMRI, although its utility when studying sound sequences is limited by the substantial background noise generated during scanning. Because environmental noise itself can impair perceptual learning, it is critical to first establish if and how fMRI noise affects oddball responses before applying these paradigms to clinical groups.

EEG was recorded while participants listened to alternating auditory oddball sequences that contained two deviant types (longer and shorter tones), presented either in silence (n=17) or with fMRI noise (n=18). Using conventional single tone epoch analyses, both groups showed a robust mismatch negativity to deviants, indicating preserved detection of deviant sounds even in the presence of scanner noise. However, when we applied a novel long- epoch analysis spanning multiple tones (standards and deviants in sequence), a striking difference emerged: the deviant-related N2 response present in silence was absent in the noise condition for the long deviant type.

These findings demonstrate that fMRI background noise can alter perceptual learning, in ways that are only detectable when responses are examined in a broader temporal context. Standard ERP approaches may therefore underestimate the impact of noise on auditory processing, highlighting the value of long-epoch methods when combining EEG with fMRI.

Investigating the fractional occupancy of brain states during an emotionally salient video in psychosis using hidden Markov modelling – preregistration

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Schizophrenia is a disorder that affects multiple domains (thought, perception, emotion). Emotional disturbances encompass negative symptoms such as flat affect and anhedonia, alongside deficits in emotional expression, perception and recognition. Tapping into emotional processing with robust ecologically valid stimuli holds promise for characterising brain network dynamics and individual differences in psychosis.

In this study we acquired fMRI data of 80 invited participants (40 with transdiagnostic psychosis) who viewed emotional videos. We will utilise a hidden Markov model (HMM) to identify underlying brain states driven by the stimuli. We will then quantify how much time is spent in each brain state (fractional occupancy (FO)). We will link these brain states and their transitions to emotional properties of the movie. We will further validate these brain states and networks with brain maps obtained through the metanalytical open access Neurosynth

database. We will compare the FO of the different brain states for our experimental vs control groups using Bayesian t-tests. We hypothesise that there will be a significant difference in the fractional occupancy of different brain states between the two groups.

The negative symptoms of schizophrenia, characterised by impaired emotional processing, form the majority of burden of disease but remain poorly understood with no effective treatments. Studying differences in occupied brain states during an ecologically valid emotional stimulus offers novel insights into the disease. These findings will shed light on new targets for ongoing investigation and treatment formulation.

It's all in the alpha: Using MEG to investigate the temporal decoding of simple visual features during visual imagery

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Visual imagery is the ability to generate images in the mind's eye without any concurrent retinal stimulation. Previous work has demonstrated that the content of imagery can be decoded from MEG, EEG and fMRI data, with some studies finding subjectively reported more vivid imagery corresponds to neural representations that more closely resemble perception. While fMRI work has shown that low-level features (such as orientation) can be decoded from imagery in early visual cortex, MEG and EEG decoding has so far primarily focused on complex categorical visual stimuli (e.g., houses and faces). In this study, we targeted low-level visual feature, specifically colour and shape, to investigate whether such information also reliably enables within-category decoding in MEG (e.g. red triangle vs red circle). Participants with moderate to strong imagery ability (verified via the binocular rivalry imagery paradigm) performed an imagery task, imagining basic-coloured shapes for six seconds and rating their imagery vividness on a trial-by-trial basis. We applied time- resolved multivariate pattern analysis to examine if, and when, perceptual and imagery-related information was represented in MEG signals. Cross-decoding between perception and imagery trials demonstrated that there was representational overlap between imagined and perceived features. Interestingly, as with previous work on imagery and visual working memory, this cross decoding was only significant within the alpha band. The emergence of shared representations, primarily in the alpha band, aligns with recent evidence suggesting that alpha oscillations support the top-down reinstatement of sensory information during a range of cognitive tasks. Funding: ARC DE240100606.

Inner speech and the slow negative wave: Disentangling preparation and anticipation

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When we move our articulator organs to produce overt speech, the brain generates a slow negative wave (SNW) – a pre-stimulus event-related potential (ERP) associated with motor preparation and anticipation – compared to passive listening. Recent research suggests that inner speech – the silent production of words in one's mind – is also accompanied by a SNW. In these studies, participants typically watch an animation which provides them with precise knowledge about when they should produce an inner sound and hear an audible sound through headphones. However, because the inner and audible sounds occur simultaneously, it is unclear whether the SNW effect reflects preparatory activity associated with producing the inner sound or anticipatory activity associated with the audible sound. To distinguish between these possibilities, we designed an ERP experiment in which participants produced inner speech while their expectations about hearing the audible sound were systematically manipulated. In different blocks of trials, participants either expected to hear an audible sound, expected to not hear an audible sound, or were uncertain as to whether they would hear an audible sound or not. This design allowed us to disentangle the contributions of preparation and anticipation. We found that the SNW is sensitive to both

preparatory and anticipatory processes. These results advance our understanding of the neural mechanisms underlying inner speech and support the hypothesis that inner speech is a special kind of action.

Regional heterogeneity shapes large-scale wave dynamics in the mammalian cortex

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Understanding how the brain's structure gives rise to its function remains a central challenge in neuroscience. Computational models provide a powerful framework for probing this structure–function relationship. Neural mass models have been widely used to simulate large-scale brain activity, but they discretise the cortex into regions and assume uniform behaviour within each, limiting their ability to capture continuous spatial dynamics observed in empirical data.

In contrast, neural field models treat the cortex as a continuous surface, enabling wave-like propagation of activity. Here, we extended a well-established wave-based framework by implementing a spatially heterogeneous wave model, in which regional differences in cortical properties directly shaped how neural activity spread across the cortex. Heterogeneity maps were derived from structural and molecular features, including cortical thickness, synaptic density, and the T1w/T2w myelin proxy.

We applied this framework to humans, macaques, and marmosets, fitting the models to resting-state fMRI data. Incorporating heterogeneity significantly improved model–empirical correspondence compared to homogeneous models (Figure 1). In particular, the T1w/T2w map emerged as the strongest predictor, yielding better fits to static functional connectivity, dynamic fluctuations, and spatial co-activation patterns.

These findings suggest that biologically-informed heterogeneity is a critical determinant of large-scale cortical dynamics. By refining wave-based models with empirically measured tissue properties, this work provides a parsimonious framework that generalises across species and helps bridge the gap between structural anatomy and functional brain organisation.

Testing for expectation suppression in auditory predictive cueing designs using multivariate pattern analyses and electroencephalography

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Statistical regularities in our sensory environment allow us to form expectations about what we will encounter in the world. Expectation suppression, an effect proposed under predictive coding accounts of sensory processing, describes the reduction of neural activity in response to predictable sensory input. Previous work in vision using predictive cueing designs, in which participants learn predictive relationships between successive stimuli, has not reliably identified evidence for expectation suppression when controlling for known confounds. We tested whether we could identify expectation suppression in audition using a highly comparable experiment design to past studies that presented visual stimuli. Participants were trained to associate visual cues with the presentation probabilities of different auditory tones while we recorded electroencephalography (EEG). In each trial a cue stimulus appeared, followed by an auditory tone that could be either expected (80% probability), surprising (20% probability), or neutral (50% probability). A second tone was subsequently played, which could be either the same or a different frequency as the first tone. Participants indicated whether the first and second tones matched in each trial. We trained multivariate

classifiers to discriminate between expectancy conditions based on patterns of auditory evoked EEG responses. Classifiers did not reliably perform at above- chance levels, indicating that distributed patterns of EEG responses did not substantively differ across expected, neutral, and surprising conditions. Our findings do not support an attenuation of globally distributed activity in auditory-evoked EEG responses and are thus inconsistent with theoretical accounts of expectation suppression.

Motion and position illusions: Beyond predictive processing

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Predictive processing frameworks have strongly influenced theories of perceptual phenomena. This includes the motion-position illusions, where motion is associated with perceiving an object's position as shifted in its direction of motion. In the case of the flash- lag effect and some other motion and position illusions, we argue that the popularity of the predictive processing account has gone too far, with evidence that is inconsistent with extrapolation (e.g., the flash-lead effect) being minimised. While a predictive extrapolation process likely plays a role in these illusions, we review evidence that some (including the flash-lag effect) are caused in part by a temporal error mechanism, such as triggered position sampling, intermittent position updating, or temporal mis-binding. Postdiction is also likely involved. The assumption that motion and position illusions instead are all caused by predictive processes has held back understanding of these illusions and, we argue, has led researchers to cite the flash-lag effect in support of predictive processing when in fact it provides little support. We describe how investigation of certain other motion and position illusions (e.g., the flash-grab effect and de Valois & de Valois motion-induced position shift) is best for identifying the underlying mechanisms.

The neural and behavioural markers of visual hallucinations in age-related macular degeneration

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A subset of individuals with age-related macular degeneration (AMD)—a retinal disease that causes central vision loss—experience complex visual hallucinations, the hallmark of Charles Bonnet Syndrome (CBS). The predominant mechanistic theory for CBS is that deafferentation leads to widespread hyperexcitability in the visual cortex. However, there are currently no biological markers of hallucination proneness in AMD which is stifling the diagnosis and treatment of CBS. This project aims to develop a behavioural and neural marker of CBS in AMD. To this end, we will recruit a large sample of individuals with AMD, with and without CBS, and measure sensitivity in a continuous flash suppression (CFS) paradigm as well as the excitation/inhibition (E/I) balance in the visual cortex using EEG. In CFS, a dynamic mask presented to one eye suppresses awareness of a target gradually increasing in contrast in the other; the contrast at which the target "breaks through" indexes perceptual sensitivity. If hyperexcitability is responsible for hallucinations, we predict that individuals with CBS will respond to the suppressed target faster than those without CBS, as they may require less stimulation to activate population-level activity in the visual system. To estimate cortical excitability, we will perform spectral power analyses and a model-based assessment of E/I balance in the visual cortex. We predict that individuals with CBS will show greater cortical excitability in visual areas compared to non- hallucinating AMD patients. Together, these experiments will generate the first candidate biomarkers of CBS, advancing mechanistic accounts and guiding future diagnosis and treatment.

Multiple Simultaneous Representations: Parallel Encoding of Spatial and Non-Spatial Information in Change Detection

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The visual system operates over a broad range of tasks across changing environmental conditions. We hypothesised that one way the visual system achieves such flexibility is by encoding

multiple simultaneous representations of a visual scene, each of which can be invoked according to task demands. To experimentally test this idea, we designed a paradigm in which various scene features were redundant for some tasks but not others. We predicted that redundant information would be encoded by the visual system even when it is not task-relevant. We therefore quantified the extent to which redundant features were encoded and weighted in perceptual decision-making across differing task constraints. Replicated across two experiments, participants performed a change detection task in which they had to compare two sets of colours under varying conditions of redundancy. In the redundant condition, study and test displays shared the same spatial configuration, but changes were correlated with non-spatial information (i.e. non-spatial information was redundant). In the minimal condition, spatial correspondences were destroyed so that the change task could only be solved by using non-spatial information. A model-based analysis revealed that redundant information was available even when it was not task-relevant: observers weighted redundant, non-spatial information by as much as 58% in their perceptual decisions, demonstrating that the visual system encodes multiple scene representations in parallel. These results support a computational account in which population codes assign reliability across distinct representational dimensions, and each dimension is dynamically weighted according to specific task demands when making perceptual decisions.

Threat Generalization in Adolescence: Perceptual vs. Conceptual Similarity

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Threat generalization is an adaptive process in which conditioned threat responses are extended to new unconditioned stimuli that share perceptual similarity (e.g., circles in different colors) or conceptual similarity (e.g., dog collars or parks when fearing dogs). While threat generalization serves as a protective mechanism for survival, overgeneralization can become maladaptive, leading to unnecessary defensive behaviors. Compared to adults, adolescents often show greater threat overgeneralization, likely reflecting reduced discrimination between threat and safe stimuli. However, few studies examine perceptual and conceptual features simultaneously, obscuring understanding of whether top-down or bottom-up processes facilitate the development of adaptive generalization.

The current study examined how perceptual/conceptual distinctions shape generalization from adolescence to adulthood (adults: N = 30, ages 18-40; adolescents: N = 34, ages 12-17). Participants completed an fMRI task in which they were instructed to adopt the persona of animals (lion, hyena, or antelope) with varying health levels (high, medium, or low) and to judge their likelihood of winning battles against opponent animals from the same set of species, also varying in health. Generalization was guided primarily by conceptual similarity (health status) rather than perceptual similarity (animal identity). Adolescents exhibited more nuanced and asymmetric patterns of generalization than adults. Stimulus similarity type (conceptual vs. perceptual) and self-relevance (self-identity/health vs. opponent identity/health) differentially engaged sensorimotor and visuospatial networks, as well as regions important for threat processing (hippocampus and insula). Findings reflect a stronger susceptibility to context-related modulation of defensive responses during adolescence.

Revealing rhythm categorization in human brain activity

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Human experience of music entails the ability to map the vast variety of rhythmic inputs onto a discrete set of internal rhythm categories. Yet the nature and neural mechanisms of rhythm categorization remain poorly understood.

We recorded scalp electroencephalography (EEG) while participants listened to a continuum of rhythms made of two intervals with ratios ranging from even (isochronous) and uneven (long-short). Using representational similarity analysis, we show that the elicited EEG activity goes beyond mere tracking of acoustic features and, instead, reflects two discrete categories. Importantly, these neural categories are compatible with behavioral categories captured separately via sensorimotor reproduction, yet they emerge automatically, without a related explicit task.

To test whether this automaticity could reflect low-level physiological mechanisms in subcortical auditory nuclei, we used a functional localizer isolating EEG activity from cortical vs. subcortical regions. Results indicate that while cortical rhythm categories cannot be fully explained by subcortical responses, rudiments of rhythm categorization arise early in the auditory pathway.

Finally, to probe whether these observations could reflect categorization based on whether a rhythm comprises equal versus unequal intervals, we recorded magnetoencephalography (MEG) while participants listened to a set of three-interval rhythms that did not include isochrony. Preliminary results confirm automatic neural categorization of rhythm, thus ruling out the interpretation that the implicit neural correlate we identified merely reflects anisochrony detection.

Together, this work advances our understanding of the fundamental constituents and biological substrates of musical rhythm, and opens new possibilities for explaining the universality yet diversity of rhythm worldwide.

Causal role of left pre-SMA and IPC in cognitive flexibility

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Cognitive flexibility enables individuals to switch between tasks, update goals and disengage from irrelevant activities, thereby supporting creativity, problem-solving, and learning. Task-switching often incurs a 'switch-cost', reflected in slower and more error- prone responses. However, the mechanism of switch-cost remains unclear. To address this, we used a number-letter switching task with simultaneous EEG-recording to examine sensor- and source-level brain activations in 25 healthy human participants. We examined four behavioural conditions: no switch (NS), motor-switch (MS), cognitive switch (CS), cognitive-motor switch (CMS). As expected, participants performed worst in CS trials, showing significantly slower reaction times, reduced accuracy, and higher normalized reaction times. On the basis of literature on fMRI with task-switching paradigms, we hypothesised activation in the medial-frontal cortex and left frontoparietal cortices. In line with our hypothesis, EEG analyses revealed differential activations in the left pre- supplementary-motor-area (pre-SMA) and inferior-frontal-gyrus (IFG) for CS vs. NS trials, and in the left inferior parietal cortex (IPC) for CMS vs. MS trials. Left pre-SMA and left IPC were subsequently targeted in a TMS–EEG experiment (N = 11, ongoing). Stimulation selectively impaired performance in CS trials at both sites, reflected in increased normalized reaction times. These findings build on prior fMRI work implicating pre-SMA and IPC in task-switching and provide the first causal evidence in humans that both regions are causally involved in the switch-cost. Our results establish the left pre-SMA and IPC as key nodes of the cognitive flexibility network and identify them as potential targets in disorders marked by impaired flexibility.

Time-to-Arrival Judgements and Visual Prediction: How Electric Micro-Mobility Devices Challenge the Human Perceptual System

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Electric micro-mobility devices (EMDs), including e-scooters and e-bikes, represent a novel class of road users now proliferating across urban roads globally. Unfortunately, the rapid uptake of this technology has coincided with increasing collision rates involving motorists, often resulting in serious injury or death. Emerging evidence suggests that drivers may systematically misjudge the speed and trajectory of EMDs more frequently than other small vehicles. To investigate the perceptual biases contributing to these errors, we conducted an ecologically valid psychophysics experiment assessing motorists' ability to estimate time-to- arrival (TTA) for oncoming novel EMDs (e-scooter and e-bike) and more familiar vehicles (bicycle, motorcycle, small car, large car, truck). Initial findings indicate that TTA is overestimated across all speeds and vehicle types, and that this overestimation increases with both higher speeds and longer prediction intervals for all vehicles, consistent with previous literature. Moreover, preliminary analyses suggest that the pattern of overestimation of TTA across speeds might be subtly different for EMDs, as compared to more familiar vehicles. These preliminary results suggest that although speed and

prediction interval are primary drivers of perceptual error, the influence of vehicle type may moderate these effects in nuanced ways.

Exploring Neuroplastic and Functional Outcomes of a Virtual Sailing Intervention for Major Depression: A Study Protocol

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Background: Major Depressive Disorder (MDD) impairs emotional regulation and motor function due to neurobiological disruptions. Exercise can reduce symptoms, but adherence is often poor. Sailing offers physical and cognitive benefits, yet safety and access limit feasibility. Virtual Sailing (VSail) provides a safe, engaging simulation requiring motor coordination, decision- making, and cognitive effort. This multimodal activity may replicate exercise benefits while overcoming barriers, making VSail a promising approach to enhance neuroplasticity and rehabilitation in MDD.

Aim: To evaluate VSail's feasibility and efficacy in reducing depression and enhancing motor coordination, cognition, and neurometabolic profiles in MDD.

Methods: Forty adults (18–64) with MDD will be recruited for six weekly 30-min VSail sessions. Exclusion criteria are suicidality and severe comorbidities. Pre/post assessments will measure depression, motor coordination, and functional capacity. Neuroplasticity will be examined with MRS of GABA, glutamate, and NAA in cortico-limbic regions. Cognitive function will be assessed using validated digital tools. Biochemical and cognitive data will be correlated with clinical and functional outcomes to clarify VSail's neural effects.

Discussion: This trial combines digital exercise with cognitive neuroscience to test a non- pharmacological treatment for MDD. VSail may improve engagement while stimulating the brain, with neuroimaging clarifying its effects on neuroplasticity.

Conclusion: This study will provide evidence supporting VSail as a novel intervention for depression.

Significance: This first study evaluates VSail's therapeutic potential in MDD using a comprehensive neurofunctional framework, providing evidence to guide scalable interventions and future trials.

Keywords: VSails, MDD, neuroplastic, cognitive, motor coordination

Exercise-induced lactate mediates working memory and neural activity during different training intensities

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Background: Exercise is recognised to positively impact cognition and brain plasticity. However, the extent to which physiological response differences from various training intensities impact neurocognition is unknown. This study examined whether lactate mediates changes in executive function (EF) and dorsolateral prefrontal cortex (dlPFC) neural activity after moderate- and high-intensity exercise. Methods: 55 healthy adults underwent duration-matched moderate-intensity continuous training (MICT) and high- intensity interval training (HIIT) on a cycle ergometer. Fingerpick capillary blood pre- and post-exercise measured lactate concentration. Stroop and N-back tasks evaluated inhibitory control and working memory EF domains. Functional near-infrared spectroscopy (fNIRS) over the dlPFC recorded neural activation, characterised as task-related changes in oxyhaemoglobin (Δ[HbO]). Moderated mediation models analysed the mediating effect of lactate change post-exercise on EF, adjusted for age, sex, VO2 max, blood glucose, and body mass index. Results: Lactate mediated the influence of exercise intensity on accuracy scores (β = -0.08, CI = -0.16 to -0.002) during N-back and across bilateral (β = 0.14, CI = 0.03 to 0.25), left (β = 0.14, CI = 0.03 to 0.25), and right dlPFC Δ[HbO] (β = 0.13, CI= 0.02 to 0.24) during congruent Stroop. Individual pathways showed that HIIT was associated with higher lactate produced, compared to MICT. In turn, higher lactate production was associated with reduced N-back accuracy and greater congruent Stroop dlPFC Δ[HbO]. Discussion: Changes in lactate from varying exercise intensities modulated behavioural outcomes during working memory and neural activity during inhibitory control tasks. Results suggest domain- and intensity-specific cognitive benefits rather than global effects.

Smooth movements are slow but not necessarily accurate

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Human movements are variable. One manifestation is the speed-accuracy tradeoff (SAT); faster movements tend to have larger errors. Other variability arises across time; movements can be smooth or jerky. However, smoothness is challenging to quantify and is rarely linked to the SAT. We predicted that smoother movements should be both faster and more accurate. We developed a variant of a common unilateral gross manual dexterity task, the Box and Block Test. Participants (n=18) performed 32 trials of 16 unique reaches. In each trial, they moved sixteen 2.5 cm blocks to a 4x4 grid of target locations, allowing measurement of speed and accuracy of each reach-to-place movement. Movement smoothness was quantified using log dimensionless jerk (LDLJ) from body kinematics captured with a Vicon tracking system. Across reaches to a single location, movement duration (1/speed) and placement error (1/accuracy) showed the expected SAT (median correlation across participants, r = -0.21). Surprisingly, across the 16 locations, those that were performed faster were also more accurate (r = 0.22), demonstrating motor affordances inconsistent with the SAT. Critically, movement smoothness (LDLJ) was positively correlated with reach-to-place duration (r = 0.34) but not error distance (r =-0.03). Smoother movements were slower, but not necessarily more accurate. We showed that healthy adults can trade movement accuracy against speed,

but certain reaches remain difficult regardless of duration. Movement smoothness reflects a separate tradeoff with speed, but does not predict accuracy. These findings highlight the importance of considering accuracy and smoothness in dexterity assessments.

Post-acute changes in cognition following psychedelic treatment: A systematic review of clinical and preclinical evidence

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Psychedelics have re-emerged as promising treatments for a range of conditions, including depression, anxiety, post-traumatic stress, feeding & eating, and substance use disorders. Therapeutic efficacy is proposed to derive from an induced post-acute 'window of neuroplasticity' during which neural circuits are more amenable to change, ultimately addressing the cognitive inflexibility and rigid, maladaptive thought patterns and behaviours that are core transdiagnostic features of many psychiatric disorders. This systematic review seeks to comprehensively synthesise preclinical and clinical literature examining the enduring (≥1 day) effects of psychedelics on cognition.

MEDLINE, EMBASE, APA PsycInfo and Web of Science were searched from inception to 21

July 2025. A combination of MeSH terms and keywords were used to identify papers investigating classic and non-classic psychedelics (LSD, psilocybin, mescaline, ayahuasca, dimethyltryptamine, MDMA, ibogaine, ketamine) and cognition (executive functioning, cognitive flexibility, response inhibition, cognitive control, working memory, attention, decision making).

Searches yielded 3229 preclinical and 4001 clinical studies. Following deduplication in Endnote and Covidence, 2346 preclinical and 2697 clinical articles were screened by two authors (CK, BC preclinical; CK, LZ clinical). 70 (21 preclinical and 49 clinical) articles met inclusion criteria. Majority of studies administered ketamine (72%), followed by psilocybin (9%), LSD, MDMA (7% each), and other psychedelics (4%), in predominantly clinical populations/psychiatric animal models (68%) compared to healthy samples. Post-acute improvements in cognition were most consistently reported in psilocybin studies, whereas other psychedelic agents demonstrated inconsistent results. We discuss the findings in relation to hypothesised therapeutic mechanisms.

Learning transfer is hindered by stable contexts and the formation of routines during practice

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The conditions that motivate learning transfer have been debated for over a century. Recent work suggests that learning tasks in unchanging contexts drives greater segmentation between tasks, which in turn limits the extent to which task components can be joined across tasks to support performance in novel situations. These limits in transfer may also be moderated by the formation of inflexible task routines while training in unchanging task contexts. We tested these hypotheses using a task where participants search for targets hidden in a display of 20 circles. Participants learn to search for targets in two displays, each surrounded by a different coloured border. Coloured borders signal different subsets of four locations where the target will be found and are thus used to delineate between two tasks. To manipulate the stability of contexts, participants undergo training where they experience a 5% (Stable Contexts) or 30% (Variable Contexts) chance of switching between tasks. Transfer is assessed in three novel tasks, signaled using new coloured borders. One task reuses all four target locations from one learned task (Complete Transfer) while another uses two locations from each learned task (Partial Transfer). A third task uses entirely new target locations (Novel task). Preliminary findings suggest that Stable Contexts drive a more regular ordering of responses, which

correlates with impaired performance on Partial Transfer. These findings support the theory that stable contexts promote task segmentation which hinders transfer and is in part, moderated by the formation of task routines.

Predicting delirium vulnerability from pre-surgery neurophysiological measures: A protocol for the DIVULGE 2 study

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Delirium is characterised by acute and fluctuating impairments in cognition (primarily attention) and arousal. There are three subtypes: hypoactive, hyperactive and mixed. It is seen across the lifespan but is most common in late-life, with around 25-30% of older adults in hospital experiencing delirium. Delirium is associated with increased mortality, cognitive decline, functional decline and incident dementia. Delirium risk centres on brain disintegration yet empirical data are lacking. Here we describe the Dellrium VULnerability in GEriatrics (DIVULGE) 2 study protocol, which follows on from DIVULGE 1, a pilot study of n=58 reporting aperiodic differences at rest and auditory oddball ERP differences in those who developed delirium (Boord et al., 2024). Here, we will collect 64-channel EEG during rest and a frequency-auditory oddball (focusing on mismatch negativity) from n=350 older adults (>65 years) prior to an elective procedure and link with delirium outcomes post-surgery. We aim to identify patterns of neural activity associated with incident delirium and its subtypes. Findings have the potential to transform clinical practice, by enabling those at high delirium risk to be identified for clinical care to be tailored and prevention strategies targeted. There is evidence that delirium is partly preventable however current methods of identifying those at high risk perform poorly. Results will also provide some of the first empirical data testing neurophysiological theories of delirium subtypes. This level of understanding will lead to the development of novel interventions for delirium prevention. Funded by NHMRC Ideas grant GNT2028599, 2025-29.

Anodal HD-tDCS for Inhibitory Control in Autism: A Pilot Study

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Impulsivity has been under-researched in autism, despite its potential impact on daily functioning. Inhibitory control, a core mechanism underlying impulsivity, is linked to activity in the ventrolateral prefrontal cortex (vlPFC). In autism, impairments in this domain have been associated with difficulties in emotion regulation, social interactions, cognitive–behavioural flexibility, and vulnerability to addictive behaviours.

This study examined whether anodal high-definition transcranial direct current stimulation (aHD-tDCS) targeting the right vlPFC could enhance inhibitory control in autism. We conducted a randomised, sham-controlled, double-blind, crossover clinical trial. aHD-tDCS was administered at 1.693 mA for 20 minutes over the right vlPFC across four consecutive days while participants completed the Stop Signal Task (SST). Participants underwent both active and sham aHD-tDCS, with a three-week interval between conditions. The final sample included twelve participants with autism (7 males; mean age = 25.08 years, SD = 7.20).

Generalised linear mixed models were used to examine the effect of aHD-tDCS on SST response times, with treatment (active versus sham) as a fixed effect. There was no significant effect of treatment condition on SST performance ($F(1, 67.9) = 0.08$, $p = .779$). This pilot study found no evidence that aHD-tDCS over the right vlPFC improves inhibitory control in autism. The intervention was well tolerated, with no serious adverse events reported, supporting its short-term safety.

Decoding Neural Responses to Partly Occluded Objects in 6- Month-Old Infants

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Behavioural evidence suggests that infants develop expectations about the physical world early in life, demonstrating an ability to perceive partly hidden objects as unified entities early in infancy. However, little is known about the neural basis of infants' object perception under occluded conditions – specifically, whether partially-hidden objects evoke similar neural responses to their unoccluded counterparts. We investigated this using time-resolved multivariate pattern analysis of EEG data recorded in six-month-old infants as they viewed images of four distinct objects (bear, penguin, rocket, tower) that varied in terms of colour (pink vs. blue), retinal size (~8o vs. ~13o), and occlusion level (unoccluded vs. partially occluded). The occluders were fixed-size rectangles containing a Gabor stimulus of either high or low spatial frequency, positioned to occlude either the left or right half of each object. This fully-crossed design allowed us to examine visual representations at multiple levels: from low-level features such as occluder position, to higher-level representations of object identity and category. Preliminary results suggest that infants' neural responses encoded information about both object and occluder characteristics. Of particular interest is whether neural representations of object identity and/or category are maintained across changes in occlusion, which, if observed, would provide some of the first neural evidence for occlusion-invariant object processing in the infant brain, and offer new insights into the developmental trajectory of object vision in the first year of life.

The interaction between stress, schizotypy and the hemispheric lateralisation of language

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The left hemisphere (LH) is superior for lexical processing compared to the right hemisphere (RH). Prior research argues that individuals with schizophrenia, and those high in schizotypal traits, are more likely to exhibit atypical language lateralisation. Similarly, individuals under acute stress show RH advantage for language compared to non-stressed controls. Despite schizophrenia populations demonstrating altered stress reactivity, the interrelationship between stress, schizotypy and hemispheric lateralisation remains unclear. This study investigated the effects of acute stress induction on language lateralisation and the relationship with schizotypal traits. Using a within-subjects design, 20 participants completed the Maastricht Acute Stress Test (MAST), involving hand immersion in ice-cold water and a no-stress control condition using lukewarm water, in counterbalanced order. To examine behavioural language lateralisation, a lexical decision divided visual field task was administered. Stimuli (words or nonwords) were presented to either the left or right visual field for 170ms, 2.6° from central fixation. Participants responded via button press. Finally, participants completed the Schizotypal Personality Questionnaire. Findings indicate overall faster reaction times to stimuli presented in the right visual field, validating the LH's superior performance in language processing. While acute stress had no effect on lexical decision performance, a significant interaction between schizotypy and visual field revealed that the right visual field advantage disappeared as levels of schizotypy increased, demonstrating bilateral hemispheric language processing in high levels of schizotypy. These findings show evidence for atypical language lateralisation in individuals with high schizotypal traits, supporting the view that schizotypy shares underlying neurobiological mechanisms with schizophrenia.

Thinking on your feet: Perceptual and motor inhibition during step initiation in young and older adults

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Inhibitory control is needed to rapidly modify initiated steps following changes in environmental surroundings. Trips and slips during stepping are a significant concern for older adults, yet the contribution of inhibitory control to stepping behaviours in older populations remains unclear.

This study investigated step selection speeds in response to a Flanker Task (measuring perceptual inhibition – PI), the Stop Signal Task (measuring motor inhibition – MI), and the interaction of PI and MI in a Stop-Signal Flanker task, in 25 young (18-36 years) and 28 older adults (60–90 years). Bilateral force plates measured ground reaction forces and foot- lift timing. Prefrontal fNIRS recorded event related haemodynamic changes associated with PI and MI during stepping.

Across both age groups, PI trials (i.e., with incongruent flankers) resulted in slower step initiation and more postural adjustment errors relative to control trials. Relative to young adults, older adults demonstrated slower step initiation and were more likely to make postural adjustment errors on PI trials. MI times were longer in older than young adults, but were not significantly influenced by PI. Age differences in PFC activity were not observed when step initiation and cancellation involved PI.

Young and healthy older adults engage the PFC in a similar manner during step initiation and cancellation, but older adults demonstrated poorer MI and PI than young adults. Findings support theories of age-related neural compensation, suggesting that when cortical compensation does not occur, older adults are slower to complete challenging sensorimotor tasks. Results challenge the notion that PI and MI are interactive processes.

Only a matter of time: Developmental heterochronicity captures properties of the human connectome

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The mechanisms which shape the human connectome, the network of neuronal connections in the brain, remain elusive. Models of the human connectome have shown that a simple trade-off between the energetic costs and functional benefits of forming a connection can capture many, but not all, network features. Yet, these models often overlook key developmental constraints. Spatiotemporal patterns of cortical development are guided by morphogenic gradients during early brain development. Differences in timing of developmental events across the cortex — cortical heterochronicity — may provide an additional constraint on connectome formation and organisation.

We developed a new generative model of the human connectome incorporating cortical heterochronicity. By simulating the propagation across the cortical sheet of developmental gradients with focal origins, we allowed network connections to form along a strict spatiotemporal schema. Simulated networks were evaluated on their ability to replicate empirical network properties, including nodal degree, clustering, modularity, and connection length distribution. Additionally, we compared the networks to existing leading trade-off models.

Simulated models with dual developmental origins located in the hippocampus and anterior frontal cortex best captured all empirical network properties, outperforming networks generated with one, or three origins. All models substantially outperformed trade-off models in reproducing empirical network features.

We created a novel generative network model informed by early cortical development. The best performing models had origins which mirrored known developmental and morphological gradients, with the best two-origin models resembling the dual origins theory of cortical development. Our findings show heterochronicity occurring along spatial gradients combined with wiring-costs constrains cortical connectivity.

Cannabidiol Modulates Right Fronto-Parietal Connectivity in Autistic Children: A Secondary EEG Analysis from a Randomised Placebo-Controlled Crossover Trial

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Autistic children frequently show atypical long-range cortical connectivity. Cannabidiol (CBD) is a promising intervention, but its neural mechanisms in paediatric autism remain unclear. We analysed resting-state EEG from a randomised, double-blind, placebo-controlled crossover trial evaluating 12-week oral CBD oil (Medigrowth CBD100) to test whether CBD modulates functional connectivity.

Twenty-nine children (5-12 years) completed two 12-week interventions (CBD, placebo) separated by an 8-week washout; eyes-open resting EEG (5 min) was acquired pre- and post-periods in a subset (n=19; 18 usable datasets). Weighted phase-lag index connectivity was computed across five frequency bands (delta-gamma) for 16 a-priori anterior-posterior and fronto-parietal electrode pairs. Within-subject post-minus-pre connectivity differences were tested with paired t-tests and false-discovery-rate (FDR) correction per band.

CBD increased beta-band connectivity between right frontal (F4) and right inferior-parietal (P8) electrodes (p=0.001; pFDR=0.003). A trend towards increased alpha-band connectivity was also observed but did not remain after FDR correction (p=0.036; pFDR=0.071). No frequency band showed significant pre/post differences for placebo (pFDR>.60). Exploratory correlations indicated larger alpha and beta increases at F4-P8 were associated with improvements on social communication (Social Responsiveness Scale-2) and adaptive socialisation (Vineland-3) measures, though none remained after FDR correction.

These findings provide preliminary evidence that 12 weeks of CBD may alter right- lateralised fronto-parietal communication implicated in social cognition in autistic children. Replication in larger samples and task-based EEG is warranted to clarify mechanisms and individual variability. The data demonstrate feasibility of incorporating EEG connectivity biomarkers into paediatric CBD trials and suggest a putative neural pathway linking CBD to clinical social outcomes.

Systematic review and meta-analysis of the development of post-error slowing in typically developing children and adolescents

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Metacognitive regulation allows individuals to monitor and evaluate their performance and change strategy by exerting cognitive control. After making an error on a task, people often slow down. While this may initially reflect a maladaptive capture of attention by the error, it can be followed by an increase in cognitive control engagement or adaptation in goal- directed

behaviour to improve performance. Studying the development of post-error slowing (PES) across various tasks, during childhood and adolescence will enhance our understanding of the mechanisms underlying PES, providing insight about the domain- generality of cognitive and metacognitive control and their underlying neural systems, which show prolonged structural development into adolescence. Here we report an ongoing pre-registered systematic review and meta-analysis of experimental studies of PES that aims to provide a synthesis of the mixed results observed across tasks and development. Post- error behavioural measures will be entered into multilevel meta-analyses to assess their developmental trajectory. The potential effects of task characteristics will be investigated, including task type (e.g. response inhibition, switching, arithmetic), interstimulus interval (ISI), task difficulty (mean accuracy and reaction time), distribution of trial types, and number of trials. Through preliminary literature review, we predict that greater PES will be observed when tasks have a longer ISI, reflecting more adaptive adjustments in behaviour, and that PES magnitude may peak around 9 years of age. Better understanding the development of children's ability to adjust their post-error behaviour could inform the design of cognitive trainings and learning interventions to support children's metacognitive skills and academic achievement.

Estimation of Uncertainty of Socio-Affective Stimuli in Individuals with Constricted Affect

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Schizophrenia is a complex disorder encompassing various symptom clusters such as positive and negative symptoms. While neuroimaging and computational mechanistic investigations have improved our understanding of positive symptoms (Adams et al., 2013), negative symptoms remain poorly understood. A recent proposed mechanistic hypothesis about blunted affect suggests that affective blunting may be a consequence of overestimating the volatility of other people's affective reactions to one's own affect (Jeganathan & Breakspear, 2021).

We designed a study to test this hypothesis with people from the general population scoring on opposite ends of the constricted affect dimension of the Schizotypal Personality Questionnaire (SPQ; (Raine, 1991)). Invited participants completed two novel trial-by-trial PE-learning tasks: (1) The SAP (Social Affective Prediction) task which operationalizes saPE- learning and (2) the SAPC (SAP Control) task that captures PE-learning in a different context. The tasks both featured the same underlying fixed outcome sequence over 120 trials, which was selected based on simulations and revealed strong parameter recovery. Data acquisition is ongoing and will conclude at the end of October. We have currently acquired data with 17 of 42 participants. The acquired data will be fit with a categorical generalized Hierarchical Gaussian Filter, a generative model that captures PE-learning under uncertainty. We will report Group (high, low scorers) x Task (SAP, SAPC) interactions on the model parameters capturing learning about predictability and volatility of the environment.

Occluded objects: more than meets the eye? Differentiating between anticipatory location representations and signals of object permanence

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An object moving behind something else is still perceived to exist, for example, a bike moving behind a tram. While the concept of object permanence is long established in

psychology, the information available about hidden objects at the neural level has not been fully resolved. To address this, we applied time-resolved decoding techniques to EEG signals from 22 observers passively tracking a moving object occasionally occluded from view. Position maps were generated from cross-decoding between visible static localisers and the moving object as it disappears behind and then reappears from a second static object. These spatiotemporal maps were compared to those when the object disappeared entirely. Our results show an overshoot in the representation of the object location in both cases, implying some similarity of motion processing. However, contrary to what might be expected by notions of object permanence, there is no continued representation past this point. This neither supports the idea that the object continues to be represented as if seen, nor 'jumps' to and persists at the location the object will reappear from (as has been previously reported). Instead, results suggest a tentative alternate form of 'anticipatory' signal: shortly after the overshoot, a transient representation is seen of the location of reappearance. Preliminary results from a second experiment suggest that these are not anticipatory in nature, but rather a product of the dampened offset signal when objects persist. This has implications for how we interpret MVPA results and how conscious but invisible objects are signalled in the brain.

A Formal Computational Model of Suffering and Meditative Progress

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Suffering is an intimate human experience. However, its underlying computational mechanisms remain elusive. Buddhist insight meditation is said to reduce not only the presence of suffering but also its perpetuation, by dismantling its core underlying causes. This raises a compelling possibility: can we clarify the computational mechanisms of suffering by modelling what insight meditation does and how it achieves this reduction?

First, drawing on meditative insights, we conceptualize dynamics of suffering as self- reinforcing action-perception cycles. Second, we formalize these cycles using the active inference framework: an in-silico agent minimizes free energy while it navigates a grid world containing energy sources and hazards. Crucially, unlike standard active inference or reinforcement learning agents, we endow both the agent and the hazards with the ability to operate at multiple, distinct sampling rates. This multi-temporal structure introduces urgency into the agent's environmental interactions, with high-frequency operation simulating the self-reinforcing cycles of suffering. Third, we model meditative development through a meta-layer that, akin to mindfulness, monitors and regulates action-perception cycles. Computationally, the meta-layer learns to adaptively adjust generative model parameters, preventing self-reinforcing cycles from arising.

Our framework formalizes core Buddhist concepts such as grasping, ignorance, and suffering. We argue that purely artificial systems may not suffer in the same way as humans: lacking embodied substrates, they face no genuine urgency in relation to the real physical world (unlike our simulated environment), rendering the concept of self-reinforcing cycles meaningless as a basis for suffering.

Fixations on the speaker in dyadic social interactions predict social competencies

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Faces are an important tool of social communication. Interpreting facial nonverbal cues is crucial for understanding a conversational partner's emotions or intentions, and represents a subcomponent of broader social competencies. There is now a large body of evidence providing extensive insights into how we attend to and perceive faces. Overwhelmingly, this research has used photographs of faces, even though real social interactions involve dynamic movements, and are often interactions between multiple social partners. Thus, in

the present study, we considered whether fixation patterns when watching two actors in conversation allows insights into a person's broader social skills. A sample of 115 adults watched videos of social interactions between two actors, while eye-tracking recorded fixation patterns across the speaker and listener in the video. The Multidimensional Social Competence Scale (MSCS) was used as a self-report measure of social skills, covering a range of competencies that broadly relate to social responsiveness, and social understanding and regulation. As hypothesised, we found that fixation time on faces was associated with social competencies. In particular, nonverbal communication skills were linked to the proportion of time spent fixating on the speaker, rather than the listener, when watching two people in back-and-forth conversations. These skills reflect an individual's ability to use nonverbal behaviours such as facial expressions, gestures, and eye contact. Our findings highlight that these social skills might be dependent on how visual attention shifts dynamically to follow the speaker in a group conversation. emotions and social messages.

Hallucinations in Parkinson's disease and the relationship with structural integrity of the nucleus basalis of Meynert

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Hallucinations in Parkinson's disease are common and associated with early institutionalisation and mortality. Treatment options are, however, limited. Recent work suggests cholinergic dysfunction may be an important contributor to Parkinson's hallucinations. The nucleus basalis of Meynert (NBM) in the basal forebrain is the primary source of cholinergic projections to the cortical mantle; 90% of its neurons are cholinergic. We measured NBM integrity (volume, mean diffusivity) using structural and diffusion- weighted MRI and examined associations with hallucination frequency scores using the Psychosis and Hallucination Questionnaire in Parkinson's disease in 74 Parkinson's participants (mean age:70.1 years[SD:6.7]);62% male;median hallucination frequency score:4[SD:5];mean disease duration:8.1 years[SD:4.8]). Accounting for sex and disease duration, Bayesian linear mixed-effects models indicated evidence of a moderate association of increased NBM volume (β=0.36[95% Credible Interval:0.26-0.47],P>99%) with increased hallucination frequency. We did not find evidence for an association between NBM mean diffusivity and increased hallucination frequency scores, nor an association with cognition and increased hallucination frequency scores. Of the 74 Parkinson's participants, 59 had repeat hallucination frequency scores (mean follow-up period:3.1 years). There was no evidence that NBM volume or mean diffusivity at study entry predicted future hallucination scores. An increase in NBM volume without detectable NBM microstructural degeneration (i.e. reduced NBM mean diffusivity) may suggest that Parkinson's hallucinations could be more closely associated with cortical cholinergic pathway integrity, functional or network- level dysregulation rather than localised structural damage within the basal forebrain. Future work will examine whether cortical cholinergic pathway integrity is associated with Parkinson's hallucinations.

How the sense of control and predictability affects human stress responses

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Stress is the body's physical and mental responses to challenges, shaped by whether a stressor can be anticipated (predictability) and whether its outcome can be controlled by one's decisions (controllability). Unpredictable stressors heighten sympathetic arousal, reflected in higher skin conductance responses (SCRs). Uncontrollable stressors can also elevate SCRs, though evidence is mixed. Understanding how the combined impact of these factors is critical, as real-world stressors often involve both.

Thirty healthy adults (18–35 years old) learned the probabilistic mapping between visual cues and electric shocks while skin conductance was recorded from their hand. Each participant completed two sessions. In the controllable session, accurate shock predictions led to reduced shock intensity. In the uncontrollable session, shock intensity was unrelated to prediction accuracy. Within each session, cue-shock predictability alternated across blocks: highly predictable (90% shocks followed cues), moderately predictable (70%) and unpredictable (50%).

A 2×3 ANOVA revealed significant main effects of predictability, controllability, and their interaction (all ps < .001). SCRs were highest when aversive outcomes were unpredictable. With control, moderate predictability produced lower SCRs, similar to highly predictable condition. Without control, moderate predictability elicited SCRs similar to unpredictability.

These findings show that predictability and controllability jointly shape autonomic stress responses. Having control over the outcome modulates the impact of uncertainty, as evidenced by the absence of an SCR difference between moderately and highly predictable conditions. These results underscore the importance of integrating both factors into stress models and interventions.

Stopping to Change: Rethinking the Dynamics of Inhibition

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Response inhibition refers to the ability to cancel or modify planned actions when required. Within the laboratory, the efficiency of stopping is typically assessed using a stop-signal task (SST). A variation of this task, the stop-change task (SCT), is argued to more closely resemble everyday inhibitive control as in real-world situations we rarely abandon obsolete actions without immediately initiating another.

We extend recent theoretical models of response inhibition and single trial measures of stopping speed using electromyography (EMG CancelTime) to compare the dynamics of SST and SCT. Participants (n=24) responded with left or right button presses to an imperative signal (IS; yellow coloured circle on the side of the response) that was preceded by a biasing cue indicating the probability that each response would be required. In different conditions, participants had to unexpectedly stop the chosen response (IS turns cyan) or stop and change the response (IS turns cyan and new IS appears indicating the alternative response is required).

Responses were faster in congruent compared to incongruent trials, although stopping speed (SSRT, EMG CancelTime) did not vary due to congruence. Intriguingly, stopping was significantly faster in trials that required stopping and changing, versus those requiring only cancellation. This novel finding challenges theoretical models of stop/stop-change, indicating that the stop process varies as a function of task context.

We will discuss these results and provide additional data from a follow-up experiment designed to exclude the possibility that faster stopping in change trials resulted from cue salience rather than inherent changes in stopping efficiency.

Alpha oscillations rhythmically modulate the spatial precision of vision

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Neural oscillations in the 8-14 Hz 'alpha' range have well-established influences on visual perception. Increased alpha amplitude at posterior electrode sites is typically associated with reduced false alarm rates in visual detection tasks (i.e., changes in bias) but seems to have no effect on the quality of visual perception (i.e., its sensitivity). However, these results come almost exclusively from tasks employing low-contrast detection or discrimination stimuli, neglecting a wide range of visual behaviour. Here, we sought to test alpha's influence on the spatial precision of vision. We recorded EEG from 41 participants while they performed a vernier hyperacuity task with the stimuli titrated to each individual's discrimination threshold. We observed robust associations between pre-stimulus alpha amplitude and the accuracy of participants' responses. Signal Detection Theory analyses showed that alpha's effect was solely attributable to changes in sensitivity, with no effect on criterion. The phase of prestimulus oscillations was also predictive of subsequent performance. These results suggest that alpha oscillations robustly modulate the finest spatial scales resolvable by the human visual system, suggesting a functional role for these oscillations beyond mere changes in bias.

Limited evidence for expectation suppression in auditory predictive cueing designs as assessed using event-related potentials

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The brain continuously utilises its knowledge about the world to form expectations about future sensory events. This allows us to exploit statistical regularities in the environment. Expectation suppression refers to the theorised reduction in neural responses to expected compared to unexpected stimuli, attributed to the diminished mismatch between reality and our internal models of the world. In predictive cueing designs, whereby a cue signifies the appearance probability of a successively presented stimulus, evidence for this effect is limited when relevant confounds are considered. Recent work using visual stimuli has repeatedly not found evidence for this effect. We used a very similar design in combination with electroencephalographic (EEG) recordings to test for expectation suppression in the auditory system. Participants learned cue-stimulus associations whereby simple visual cues signified the probability of different auditory tones following the cue. These tones could appear with probabilities of 80% (expected condition), 50% (neutral condition) or 20% (surprising condition). A second tone then followed the first tone, which could be of a same or different frequency. Participants were then tasked with determining whether the second tone matched the first tone. Analyses of event-related potentials (ERPs) did not reveal clear differences across expected, neutral and surprising tone stimuli. Our findings are consistent with equivalent predictive cueing experiments conducted using visual stimuli, demonstrating a lack of clear expectation suppression effects across visual and auditory modalities. This challenges hierarchical predictive coding models of stimulus-evoked neural activity that posit the existence of expectation suppression in sensory cortex.

Neural correlates of realistic face processing in adults with autistic and ADHD traits: An fNIRS study

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Neurodevelopmental conditions such as autism and ADHD are characterised by a developmental cascade where a fundamental difference in attention allocation to social stimuli is observed. Most face perception research focuses on prototypical or exaggerated emotions; we compared these to more realistic, subtle expressions. Given the common co-occurrence of autism and ADHD, we examined both traits in a single sample, focusing on key cortical regions involved in social perception within the temporal and parietal lobes. We used functional Near Infrared Spectroscopy (fNIRS) to investigate the cortical hemodynamic response while adults (N=54) who demonstrated varying levels of autistic and ADHD traits, viewed faces derived from two distinct face stimuli sets representing prototypic and naturalistic facial expressions. Changes in oxy- (HbO2) and deoxy-hemoglobin (HbR) concentrations were measured with fNIRS to infer localised cortical activity in bilateral TPJ, pSTS, Angular gyrus and SMG. Preliminary analyses suggest different patterns of association across autistic and ADHD traits. Autistic traits related to reduced HbO_2 amplitude (left TPJ, SMG) and altered response time (faster for subtle faces: left TPJ; slower for exaggerated faces: right pSTS, AG). ADHD traits were associated with increased amplitude (right pSTS) for exaggerated and (left SMG) for subtle faces, while decreased amplitude was observed in other regions (left pSTS) for subtle faces. While preliminary, the findings highlight potential differences in how these traits shape the timing and magnitude of cortical activation, suggesting that autistic and ADHD traits are associated with similar but distinct patterns of neural response to subtle and exaggerated facial expressions.

Probing circuit-level integration of language content and probability during continuous speech understanding

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Understanding spoken language typically feels effortless and automatic, despite substantial noise and ambiguity in the acoustic signal. The brain achieves robust understanding by integrating the content of speech input with the probability of that input occurring. While this process has been studied extensively from an algorithmic standpoint, the circuit-level implementation of this computation remains unknown. Here, we examine this circuit by testing whether content and probability are encoded in spatially overlapping, adjacent, or distinct neural populations. We leverage the exceptional spatiotemporal precision of intracranial electroencephalography (iEEG), to map populations responsive to acoustic information, as well as violations of probabilistic linguistic expectations in the brains of participants listening to continuous speech (N=13, data collection ongoing). Using a large- scale linguistic corpus (CELEX) and deep neural network (GPT-2), we compute probabilistic expectations at two levels of abstraction: surprisal of phonemes in words ('phoneme surprisal'); surprisal of words in sentences ('lexical surprisal'). With temporal receptive field (i.e. encoding) modelling, we identify neural populations that encode acoustic information and linguistic probability, and examine their spatiotemporal overlap. We find evidence of distributed and partially dissociable encoding of acoustic information and linguistic probabilities, with lexical surprisal encoded across a more spatially distributed set of electrodes as compared to phonemic surprisal. Overall, our findings indicate that surprise at different levels of language is computed in distinct circuits, and within-level content and probability are supported in largely overlapping neuronal ensembles. These results provide implementational constraints on how robust speech understanding is achieved in the temporal lobe.

Decoding how task information persists in working memory

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Completing a task often requires holding task-relevant information in mind over time. However, complex tasks are made up of multiple components which can all persist in

working memory using different neural formats. As information in memory is continually reformatted around changing task demands, its neural format can also be modulated by the order in which information is encoded, complicating investigations. Here, we used neural decoding applied to magnetoencephalographic recordings to assess how information about task components (visual stimuli, relevant and irrelevant visual features, selection rules, and comparison rules) persists in working memory independent of encoding order. Participants were shown a bi-coloured stimulus, a selection rule indicating which colour to remember, and a rule indicating how to compare the selected colour to a probe colour presented after a two-second delay. Components were presented pseudo-randomly on each trial to control for recency and primacy effects. We assessed how accurately each component could be decoded across the delay period, reflecting how distinctly they were represented in neural activity over time. Preliminary results suggest that activity patterns associated with selection rules were most persistent during the delay period. However, despite decaying to near-baseline during the delay period, activity patterns associated with both the relevant colour and the comparison rule became more distinct after the delay ended and the probe appeared. These findings may indicate that both rule and feature information could be maintained in a relatively quiescent state until the moment that it can be operated on.

Funding: ARC FT230100119

Stimulus Orientation Extrapolation Arises Via Shifted Population Responses in the Visual System

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It takes time for the visual system to transform patterns of light into perception. How does the brain accurately perceive dynamically changing objects while relying on delayed information? Stimulus feature extrapolation – estimating possible future states of an object based on its history – is a proposed mechanism to compensate for such delays. While extrapolation of object position has been extensively studied, neural mechanisms supporting extrapolation of other features (e.g., orientation) are unknown. We recently proposed that feature extrapolation arises via adaptation within the visual system. Here, we tested whether orientation-selective neural representations are shifted toward probable future states when a stimulus changes predictably over time. Participants observed sequences of gratings with varying orientations presented at a rapid rate (15Hz) while electroencephalography (EEG) was recorded. In localiser sequences, grating orientations were randomly-ordered. Grating-evoked EEG responses were used to train multivariate classifiers to predict the orientation of each grating. The trained classifiers were then used to predict orientations of gratings in separate sequences that gradually rotated clockwise or counter-clockwise. We tested whether EEG responses resembled those evoked by future (i.e., not yet presented) gratings in these sequences. We could successfully decode grating orientation in randomised sequences from 80ms after stimulus onset. In predictable sequences, biases in model-predicted orientations (indicating extrapolation) were evident

~100ms after grating onset. The rapid onset of the orientation extrapolation effect is consistent with cortical adaptation altering neural population responses in visual cortex, leading to persistent biases in perception when viewing gradually changing objects.

Stacking the odds: Exploring a block-stacking virtual reality task as a more engaging alternative to the balloon analogue risk task

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Risk-taking involves behaviours that have the possibility of harm, such as smoking, gambling, and drug use, which can evolve into addictions. Accurately predicting risk-taking tendencies is essential for effective prevention and treatment strategies. One

established risk-taking task is the Balloon Analogue Risk Task (BART), but its correlations with real-life risk-taking behaviour, and the related constructs impulsivity and sensation-seeking, are questionable. This has been suggested to stem from methodological limitations causing low task engagement. Virtual Reality (VR) has been proposed to increase participant engagement and improve ecological and convergent validity of risk-taking tasks, due to its immersive nature. Therefore, RMIT has developed a VR block-stacking task that employs the BART algorithm and logic. It involves stacking up to ten blocks in 30 rounds until they fall over, or the reward is collected. This study aimed to explore the block-stacking VR-task as an alternative to the BART to predict risk-taking and explore the VR-task's validity. The pilot study used self-report risk-taking behaviour, impulsivity and sensation-seeking questionnaires, the VR-task, the BART, and author-created task engagement items, with a sample size of 30. Preliminary analysis showed that neither the VR-task, nor the BART were related to risk-taking behaviours, impulsivity, and sensation-seeking, but the tasks were correlated to each other. However, task engagement was significantly higher during the VR- task than the BART. The preliminary findings indicate that the VR-task needs to be improved further, such as by increasing the amount of blocks that can be stacked per trial and tested in a larger sample.

Motor attenuation in schizotypy

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Neural responses to sensory input are typically weaker when that input is predictable compared to when it is unpredictable. We have previously shown that the response of the motor system to direct input — achieved by applying transcranial magnetic stimulation (TMS) to the motor cortex — displays similar properties. Motor evoked potentials elicited by predictable stimulation are attenuated relative to those elicited by unpredictable stimulation. Individuals also covary in the degree of attenuation across sensory and motor domains, suggesting there may be general individual differences in prediction processing. Sensory attenuation is blunted in individuals with schizophrenia and in those high in schizotypy, and this deficit has been linked to the experience of positive symptoms. The current experiment investigated whether motor attenuation to predictable stimulation is also blunted in individuals high in schizotypy. Participants were tested on their sensitivity to two distinct forms of prediction: prediction based on agency (internally vs. externally generated prediction) and prediction based on contingency (high vs. low probability of stimulation). If schizotypy is associated with deficits in motor attenuation then it suggests that this dimension may be linked to more general prediction processing, which are not restricted to sensory experience. The findings are important for understanding schizophrenia symptomology, classification, and diagnosis.

Causal neural substrates of task-switching and metacognition

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The task-switch cost – the slowing of reaction time (RT) after rapidly switching from one task to another, relative to repeating tasks – reflects a core information processing limit in the human brain. This switch-cost can be mitigated when subjects are given time to actively prepare for task-switches; a strategic adjustment associated with awareness of one's own cognition – i.e., metacognition. While the lateral prefrontal cortex (PFC) has typically been associated with higher-order cognitive control, its causal contributions to task-switching and metacognitive preparation remain unclear. Here, we used transcranial direct current stimulation (tDCS) to determine if electrically stimulating the PFC during a task-switch paradigm can induce credible shifts in preparation and RT. We employed a balanced, independent-groups design to test the influence of different stimulation protocols on performance. Subjects (N = 210) were allocated to one of seven protocols: PFC stimulation at 0.7, 1.5, or 4 mA; visual cortex (V1) stimulation at matching dosages (serving as active, regional control); or sham (serving as baseline control). Critically, on each trial, subjects freely controlled for how long

they viewed a task cue before that trial's stimulus was presented. We observed the classic switch-cost effects along with robust preparation adjustments. Subjects actively prepared for longer on switch compared to repeat trials. However, there was no effect of active stimulation on preparation time or switch-cost. Our findings suggest that this tDCS protocol does not reliably influence the cognitive processes underlying task-switching ability; nor the metacognitive control required to prepare for a different, upcoming task.

White matter fibre correlates of atypical motor imagery performance in children with developmental coordination disorder

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Despite the important role of motor imagery (MI) in childhood motor development, few studies have examined the neural basis of atypical MI in children with developmental coordination disorder (DCD). Accordingly, this study examined the associations between MI and white matter fibre properties of the superior longitudinal fasciculus (SLF) and cerebellar peduncles (CP) in children with and without DCD. Thirty-four children aged 6–14 years participated: 11 with DCD (8 female, Mage= 11.65) and 23 typically developing controls (12 female, Mage = 10.06). Multi-shell high angular diffusion weighted imaging data (b = 0, 1600, 5000 with 8, 25, 64 volumes respectively) were collected on a 3T scanner. MI was assessed using a mental hand rotation task. The SLF and CP were reconstructed using TractSeg. Fixel-based analysis was used to derive measures of white matter microstructure (fibre density) and morphology (fibre cross-section) for each tract. Children with DCD showed less efficient MI performance than controls. However, this difference was not significant after accounting for commonly co-occurring ADHD symptomology. Permutation- based inference testing and partial correlations showed significant associations between MI performance and fibre properties of the SLF and CP in controls and of the SLF in children with DCD. In these regions, there were no significant differences between children with and without DCD. These findings highlight the possible relevance of white matter fibre connectivity to MI performance in children and provide new insights into the neurobiological principles that underlie compromised internal models in DCD.

Investigating the interaction of transcranial stimulation of prefrontal cortex with contextual factors in modulating response execution and action inhibition

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Executive control (EC) involves the optimisation and flexible use of limited cognitive resources to guide goal-directed behaviour. Balancing between response execution and action inhibition is a critical aspect of EC, often impaired in neuropsychological disorders. The dorsolateral prefrontal cortex (DLPFC) plays an important role in EC, including inhibition ability, cognitive flexibility and attention. Neuro-modulation of the DLPFC through transcranial direct current stimulation (tDCS) has the potential to enhance EC, possibly interacting with task-related

contextual factors, such as the sensory-perceptual dimensions (colour or shape) of visual stimuli.

We examined the effects of tDCS over the right DLPFC using a dimension-based stop-signal task where the inhibitory signal was conveyed in the colour or shape dimension. Performance was influenced by the stop-signal dimension and also tDCS modulation of response execution versus action inhibition. In a sham-controlled, cross-over design, thirty- six healthy participants (aged 18-35) received both anodal and sham tDCS (1.5mA for 10 minutes).

Results showed that the stop-signal reaction time (SSRT), a measure of inhibition ability, was significantly influenced by dimension, yielding better inhibition with shape-based stop- signals. Accuracy in stop-trials improved with practice, suggesting within-session learning effects. There was no difference in SSRT between anodal and sham stimulation. However, Go-trial performance, reflecting response execution, showed enhanced accuracy following active, but not sham stimulation. Thus, tDCS over the DLPFC selectively enhanced response execution but not response inhibition.

These findings elucidate the effects of contextual factors, such as visual dimension, in inhibition ability and delineate the selective effects of stimulation of DLPFC between response execution versus action inhibition.

Is this healthy ageing or Parkinson's disease? Examining the known-groups validity of a large cognitive and motor assessment battery

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In both healthy ageing and disease processes, accurate measurement of cognitive and motor decline is essential for research and clinical practice. While many assessments have been shown to be sensitive to age- and/or neurodegenerative-related changes, limited research has compared the known-groups validity of these tasks – or even the known-groups validity of individual measures within tasks – to identify which offer maximal utility. Using a large battery of cognitive and motor tasks, we critically examined the sensitivity of more than 100 measures to healthy ageing and to Parkinson's disease pathology. Cognitive tasks encompassed a range of domains, including learning, response inhibition, processing speed, and visuospatial reasoning. Motor tasks assessed bradykinesia, postural stability, gait, and rest tremor. To investigate sensitivity to healthy ageing, we compared the task performance of 450 healthy older adults (aged 60-86 years) to that of 450 healthy younger adults (aged

20-39 years), matched on sex and years of education. Sensitivity to Parkinson's disease pathology was examined by comparing the task performance of 133 Parkinson's disease patients to that of 133 age-, sex-, and education-matched healthy controls. Measures identified as most sensitive to age-related changes were not necessarily those most sensitive to Parkinson's disease pathology, suggesting that different neural substrates may be driving similar yet distinct cognitive and motor changes in healthy ageing and Parkinson's disease. Based on our findings, we make several task choice recommendations for researchers investigating healthy ageing and neurodegenerative disease.

Controlling slips of action: Acquisition and extinction of conditioned tendencies in motor cortex

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Learning to associate stimuli with a specific response can result in action tendencies that automatically prime the motor system for responding. These action tendencies can be advantageous but are counterproductive when the response conflicts with current task goals. Using transcranial

magnetic stimulation (TMS), we have been investigating the neurophysiological signatures of conditioned action tendencies in the motor system to understand how automatic motor preparation can be brought under control. Across a series of experiments, participants were trained to make a speeded response to a target stimulus in a continuous performance task. In a subsequent test session, the requirement to respond was removed and the state of the motor system was probed using TMS. In the absence of a requirement to respond, stimuli previously associated with an action increased corticospinal excitability within the motor cortex shortly before the timepoint at which a response would have been made, but resulted in suppression of excitability shortly afterwards. Over a series of experiments we then subjected the target stimulus to extinction, which should result in a weakening of the action tendencies. We have found that the excitation and suppression respond to extinction differently, with late suppression surviving longer than early excitation. The results reveal new insights into how unwanted actions are brought under control.

Cerebellar stimulation attenuates behavioural impulsivity for reward

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Dysfunction in reward anticipation has been identified as a key neurobehavioral mechanism contributing to the development and maintenance of various psychopathologies. The cerebellum is increasingly recognised for its involvement in non-motor domains, including affective regulation and reward processing. Yet, its causal role in modulating reward anticipation and outcome remains poorly understood. In this randomised, single-blind, sham-controlled study, we aimed to examine whether anodal transcranial direct current stimulation (tDCS) over the cerebellum alters reward-related behaviour. Participants completed a modified Monetary Incentive Delay Go/No-Go task before and after anodal- or sham-tDCS over the cerebellum for 20 minutes. The task probed interactions between reward anticipation and response inhibition under certain and uncertain conditions. In the absence of active stimulation (sham tDCS) participants demonstrated reward-based behavioural shifts, whereas anodal-tDCS attenuated such changes. Specifically, sham participants showed reduced accuracy on trials with certain rewards and improved accuracy on uncertain reward trials, alongside increased false alarms and diminished sensitivity (d_2), consistent with a learning-induced preference for high-risk, high-reward options at the expense of inhibitory control. Additionally, and interestingly, these changes were associated with higher scores related to alcohol use. These effects were attenuated in the anodal group and support a causal role for the cerebellum in calibrating risk-reward trade-offs and regulating impulsivity. This study provides the first experimental evidence that cerebellar stimulation can alter reward-guided behaviour in healthy adults and highlights the cerebellum as a candidate target for neuromodulatory interventions in disorders characterised by impaired reward processing and impulse control.

Aperiodic components of resting state EEG in Parkinson's disease and their relationship to mild cognitive impairment

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Detecting cognitive impairment during the early stages of Parkinson's disease (PD) can be difficult due to the nuanced changes that occur. Identifying a reliable measure of mild cognitive impairment (MCI) in PD is clinically relevant to improve prognosis of cognitive decline in the disease. We aimed to assess whether aperiodic components of resting-state electroencephalogram (EEG) might serve as a useful biomarker of MCI in PD. In four EEG datasets, we explored whether there were differences in these markers between PD participants and controls, between eyes open and eyes closed conditions, and whether they were associated with cognitive measures – in two of the datasets, the MoCA, and in two the MMSE. We used datasets from the University of New England (n = 40), the Canberra Hospital (n = 38), the University of New Mexico (n = 56), and the University of Turku (n = 40), the last two being publicly available datasets. Resting-state

EEG data was preprocessed using an established pipeline for low-density electrode arrays (HAPPE), then processed to extract the aperiodic exponent and offset using the FOOOF toolbox. In all four datasets, exponent was significantly higher in PD than controls, while offset was higher in three, after controlling for age. Exponent predicted cognitive impairment in PD participants when using the MoCA, but not in cohorts where the MMSE was used. Differences between eyes-open and eyes-closed measures were inconsistent across datasets. Overall, aperiodic components of EEG resting state data show promise as potential neural markers of cognitive function in PD.

Does altered motor function reshape the adult body map? An ultra-high-field fMRI study of Motor Neuron Disease

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The stability of adult primary somatosensory (SI) cortical maps in the face of altered bodily experience remains controversial. On one hand, SI finger maps in upper-limb amputees and tetraplegic individuals are strikingly similar to those of healthy controls, suggesting limited change in body representation despite severe sensory loss. However, habitual motor patterns are thought to be the main driver of SI organisation, as motor activity determines the timing of tactile inputs. Given this, substantial changes in motor experience may drive body map plasticity in a way sensory deprivation alone does not. Motor Neuron Disease (MND) offers a compelling model to test this, as progressive motor degeneration and impairment alter movement patterns and consequently the afferent sensory inputs to SI.

Here, we used ultra-high-field (7T) functional magnetic resonance imaging (fMRI) to map finger and body representations in SI in 8 MND patients and 15 controls. We complemented imaging with a battery of tactile perception, proprioceptive, and motor tests. This multimodal approach allowed us to investigate whether MND is associated with alterations in somatosensory maps and to assess whether impairments of somatosensory function may underpin potential map changes.

Preliminary results suggest measurable variability between patients and controls, and across modalities, providing initial evidence that this approach is sensitive to the dynamics of SI plasticity under clinically disrupted motor action. These findings support the emerging view that MND is not solely a disorder of motor neurons but involves broader neural systems.

Can we just ignore it? The effect of phone-like vibration distractions on sustained attention in a dynamic task

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Despite the many benefits of smartphones, they also frequently interrupt us. Previous behavioural research shows that even when individuals do not check their phones, they may cause distraction. However, studies examining this have relied on global measures of performance, such as overall reaction time and accuracy, without examining the time course of the

effects. In this pre-registered study, we tested the effect of phone-like vibrations on performance in a dynamic task of sustained attention, with a specific focus on the time course of recovery from any impairment. Further, we explored whether any effect reflects just a general cost of attentional capture by exogenous cues, or whether association with phones increases the effect. Participants were allocated to one of two groups: the Phone Present group, who had their phone on the table, or the Phone Absent group, who stored their phones in their bags. Both groups completed 14 minutes of a dynamic sustained attention task in which phone-like vibrations were unpredictably presented during half the blocks. Preliminary results suggest some distraction by vibration, and eye movements suggest some oculomotor capture. Gaining a fine-grained understanding of the time course of recovery from any impairment is vital to better comprehend the potential costs, especially given the general willingness to let these devices intrude at any time or place, including in high-risk situations (such as driving) where even momentary lapses in attention can have fatal consequences. Funding ARC Future Fellowship to ANR (FT230100119).

Hybrid images reveal time-dependent neural encoding of competing visual content

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Ambiguous object recognition is usually studied by reducing the amount of available information (like deleting or occluding parts of an object) or by adding noise to the image, while keeping a single ground truth. However, less is known about how the visual system resolves objects in images with multiple simultaneous ground truths, when both of them are equally probable, as is the case in hybridised images. Using a pre-trained diffusion model that creates visual illusions through noise decomposition, we created hybrid images containing information from two distinct objects, embedded in different spatial frequency bands of an image (e.g., low-spatial frequency fruits combined with high-spatial frequency parrots). By applying time-series decoding to electroencephalography data of participants viewing these hybrid images, we investigated how and when the visual system encodes information about concurrent visual categories conveyed in the same image. Results showed that the representation of the object identity changed over time, initially favouring the low-spatial frequency content, before changing to prioritising the high-spatial frequency. Our results provide new insights into how the brain encodes different types of information about objects, favouring the low or the high-spatial frequency at different times. Applied to ambiguous objects, this could tell us about the mechanisms that the brain uses to resolve their ambiguity.

The neuropharmacology of perceptual decision-making

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Perceptual decision-making is a cornerstone of cognition and decision-making deficits are hallmarks of several clinical disorders. Considerable progress has been made in identifying the neural mechanisms that underpin this ability to transform sensory information into appropriate action, but critical gaps remain in our knowledge of the specific role of certain neurotransmitters in this process. Glutamate is the brain's primary excitatory neurotransmitter and biophysical models indicate its NMDA receptors are critical for stabilising a key component of the decision process: accumulating sensory evidence over time towards a decision threshold. In this double-blind crossover study (n=20), we disrupted glutamatergic signalling with a subcutaneous ketamine dose (0.7 mg/kg)

while participants performed a 2AFC random dot motion task across baseline, placebo, and active testing sessions. We used electroencephalography (EEG) to record neurophysiological signatures of the decision-making process, including a key electrophysiological index of evidence accumulation, the centroparietal positivity (CPP). We will present behavioural and neurophysiological signatures of the effects of glutamate challenge on decision-making performance to characterise the role of glutamate in decision formation.

The Impact of Competition and Awareness Tools on Emotion, Cognitive Load, and Functional Connectivity in Digital Game- Based Learning

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Background: Digital game-based learning (DGBL) is an emerging strategy that enhances affective engagement and alters cognitive load, but its underlying mechanisms remain underexplored. This study investigates how competition and in-game affordances (i.e., real- time awareness tools that reveal opponents' behaviors) impact cognitive load, emotional engagement, and brain functional connectivity.

Method: Sixty-eight participants underwent three counterbalanced learning modes: individual mode (IM), competitive mode without awareness tools (CM), and competitive mode with awareness tools (CMA). Functional near-infrared spectroscopy (fNIRS) was used to measure functional connectivity between regions of interest. Self-reported cognitive load and emotional engagement were collected through surveys.

Results: One-way repeated ANOVA results observed significantly higher levels of negative emotion in the CMA group than IM group (p=.036). Additionally, the CMA group reported significantly higher cognitive load than the CM (p=.003) and IM (p=.005) groups. Compared to the IM group, the CMA group showed greater connectivity between the right middle frontal gyrus (MFG) and medial superior frontal gyrus (SFG) (p=.024), linked to emotional control. Conversely, the IM group had higher connectivity between MFG and right middle temporal gyrus (MTG), associated with social cognition, than the CM (p=.014) and CMA (p=.003) groups.

Discussion: These findings highlight how competition and awareness tools in DGBL influence emotion and social cognition. Increased negative emotion and MFG-SFG connectivity in the CMA condition highlight how real-time opponent awareness heightens emotional regulation demands and cognitive load when managing emotions during competition. Greater MFG-MTG connectivity in the IM condition suggests competition may reduce social processing despite opponent presence.

Constraints on Mouse Brain Function and Organisation

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Recent work has shown that human brain function can be parsimoniously modelled by geometric features derived only from cortical surfaces. These geometric features, called eigenmodes, utilise no information from brain connectivity studies; however, they are still able to model brain function more accurately than models which also include connectivity information. In humans, this connectivity information is confounded by the lack of a ground- truth connectome. Here, we aim to assess whether more accurate connectivity information – in the form of whole-brain mouse tract-tracing data – can improve the accuracy of connectome eigenmode models.

We use mouse whole brain tract-tracing studies, resting state functional MRI recordings, gene expression maps, and anatomical masks that have been processed as previously described (Figure 1A).

We first compare the accuracy of geometric vs connectome eigenmodes in reconstructing gene expression maps (Figure 1B-E). Across 4385 genes, we find that geometric eigenmodes (Pearson's r = 0.70 using 100 modes; r = 0.81 using 200 modes) are able to more accurately reconstruct gene expression profiles than connectome eigenmodes (r = 0.61 using 100 modes; r = 0.71 using 200 modes). Second, geometric eigenmodes also outperform connectome eigenmodes when reconstructing fMRI maps (geometric: r = 0.92; connectome: r = 0.87) or FC matrices (geometric: r = 0.47; connectome: r = 0.41) (Figure 1F-H).

Here, we are able to use more reliable measurements of brain connectivity to recalculate connectome eigenmodes. Geometric eigenmodes nonetheless reconstruct spatial phenotypes more parsimoniously than connectome eigenmodes. Overall, geometric eigenmodes remain a promising avenue to explore brain structure-function relationships.

Individual-level contextual alignment and aperiodic slope reveal improved comprehension of unexpected language

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In everyday language use, individuals are required to comprehend complex, continuous and often unexpected linguistic inputs. Building on perspectives from memory literature we aim to explore how individuals utilise this unexpected information to support language comprehension. Further, we propose that an individual's ability to do so is based on the interaction between their alignment to local context and their interindividual differences in information processing (as measured by aperiodic activity). A steeper aperiodic slope has been demonstrated to reflect greater adaptation of predictive models in response to prediction errors; therefore, we hypothesise that comprehension will be modulated by both alignment and aperiodic slope. To explore this, 70 participants (50F, 1 not reported; mean age: 22.2 years [SD:4.4]) listened to 12 short stories (3 genres, audio or audio-visual presentation) while their electroencephalogram (EEG) was recorded. Comprehension was tested via 6 multiple choice questions per story. Alignment was defined as the individual- level relationship between N400 amplitudes and surprisal (a text-collection-based metric of predictability). A linear mixed-effects model was computed to predict depth of comprehension from average EEG amplitudes, alignment and aperiodic slope. The model revealed an interaction of EEG amplitudes, aperiodic slope and alignment indicating that comprehension was improved for lower aligned, steeper aperiodic slope individuals and higher aligned, flatter aperiodic slope individuals. These findings suggest that unexpectedness supports comprehension when internal processing strategies complement local contextual alignment. The utility of unexpectedness demonstrated in this study has implications for improving communication and information delivery to make use of surprising continuations.

Are psychiatric diagnoses associated with a robust neuroanatomical phenotype?

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Psychiatric disorders are traditionally classified by diagnostic constructs such as the DSM, under the assumption that each disorder reflects a core neural phenotype. However, despite thousands of MRI studies reporting grey matter alterations, research has not converged on robust neuroanatomical markers for any specific diagnosis. This study examined whether current practices are likely to yield such phenotypes, which are critical for tracking illness risk, progression, and treatment.

We assessed the consistency of brain-wide cortical thickness alterations across 59 study sites for five psychiatric disorders—schizophrenia, schizoaffective disorder, autism spectrum disorder, major depressive disorder, and bipolar disorder—totalling 2,437 patients and

2,065 controls. Cross-site consistency was quantified using spatial correlations between site-specific difference maps and benchmarked against Alzheimer's disease (7 sites, 654 patients, 937 controls). Psychiatric disorders showed low consistency (median $r < 0.16$), in contrast to Alzheimer's disease ($r = 0.54$). Consistency was not explained by site-level demographic, clinical, or scanner differences, and results were robust to analytic variations.

Bootstrapping analyses suggested that schizophrenia findings could achieve moderate consistency ($r > 0.5$) when site-specific sample sizes exceeded 200 per group. For other disorders, achieving comparable reliability may require substantially larger samples.

These findings indicate that current case–control designs, typically involving 30–100 patients per site, are unlikely to yield robust diagnostic phenotypes for psychiatric disorders. Achieving this goal may be possible in schizophrenia through larger cohorts, but for other conditions, refined sampling strategies that capture more homogeneous subgroups may be necessary.

The role of pubertal timing in white matter development and mental health

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Introduction: Puberty is a key developmental period marked by significant brain changes and increased risk of mental health problems, especially for those who mature earlier than their peers. While pubertal stage has been linked to white matter (WM) changes, the impact of individual differences in pubertal timing (PT) remains underexplored. This study examines how PT affects future mental health, focusing on the mediating role of WM microstructure using restricted spectrum imaging (RSI).

Methods: The study utilised data from the ABCD study. After exclusions, the final sample included 6,300 children aged 9–12 years (46% girls). PT was estimated by regressing age from parent-reported pubertal development scores. RSI metrics—free (FND), restricted (RND), and hindered (HND) normalized diffusion—were harmonized across scanners. Analyses were stratified by sex and adjusted for covariates. Mediation analyses were conducted for WM tracts that survived FDR correction.

Results:PT was positively associated with withdrawn/depression symptoms in boys. Among girls, all eight CBCL subdomains were positively associated with PT, indicating that earlier PT predicted greater mental health problems. In boys, PT was linked to increased FND in several WM tracts. In girls, PT was positively associated with HND in the forceps minor, which partially mediated the link between PT and future thought problems.

Conclusion: While PT had a broader impact on WM in boys, changes in girls were more relevant for mental health. These findings emphasize the importance of understanding sex-specific WM changes due to PT and its role in future mental health problems.

Memory masking vs overwriting in procedural categorisation

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Behaviours acquired through procedural learning systems such as athletic skills (e.g., a cricket bat swing) are highly robust and notoriously resistant to change, even when they become contaminated by maladaptive habits (e.g., an inefficient follow-through). Identifying effective methods for modifying such procedural knowledge is therefore a major challenge. Previous work suggested that feedback contingency (i.e., the degree to which behaviour causes outcomes) is a critical factor determining whether procedural knowledge can be modified. Specifically, Crossley, Ashby, and Maddox (2013) reported that an intervention combining random and veridical feedback appeared to erase recently acquired procedural category knowledge. In the present study, we directly tested this claim. Across two experiments, we examined whether feedback manipulations lead to true unlearning of stimulus–response associations or instead merely mask their behavioural expression. We used decision-bound modelling and Bayesian estimation of reacquisition rates to provide clear evidence that mixed random–veridical feedback does not erase procedural knowledge. Instead, it merely masks expression. Learning rapidly re-emerged when participants were verbally cued that valid feedback had resumed. These findings necessitate a substantial revision of existing models of procedural category learning. They also have important implications for approaches to changing procedural skills more broadly.

Assessing the Representation of Goals in Value-Based Decision-Making: An EEG study

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Our ability to weigh the relative reward value of our options is critical to effective decision- making. However, subjective value is frequently conflated with task-specific goals in value- based decision-making paradigms. Here we address the question of whether attribute- agnostic, goal-congruent activity can be identified in EEG recordings of participants engaging in decision making.

We asked participants to rate a collection of everyday consumer products in terms of subjective value and perceived weight and then make either value or weight congruent choices using the same items. We then conducted decoding analyses to assess whether the goal-congruence, rather than just value, was distinguishable based on the goal-relevant attributes of choice alternatives. Initial findings suggest that choice times may index goal congruency when choice is dependent on physical attributes of choice alternatives, not just when choice is value based. However, event related potentials and decoding analyses show mixed evidence that task goals are represented distinct to subjective value in EEG recordings. As part of a re-evaluation of how goals are embedded in subjective value signals, this has important implications for cognitive theories in the neuroscience of decision-making and artificial intelligence.

Personalised transcranial alternating current stimulation for the treatment of depression in young people

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Depression frequently emerges before age 30, with earlier onset linked to higher relapse risk and poorer outcomes. Cognitive symptoms are common in depression, underscoring the need for interventions targeting both mood and cognition. Increasing evidence supports depression as a network disorder, reliably associated with reduced frontal theta (~4–8 Hz) activity, central to working memory and attention, and altered alpha (~8–12 Hz) activity, which predicts emotional responses and treatment outcomes. Transcranial alternating current stimulation (tACS) directly modulates oscillatory activity, offering a mechanistically

targeted approach to restore dysfunctional rhythms. We conducted a pilot clinical trial of a home-based tACS device with an individualised treatment approach targeting frequency and amplitude of alpha and theta oscillations in early-stage youth depression. Participants received 40 sessions of alpha-, theta-, or sham-tACS over four weeks. Depression severity was assessed using the Montgomery–Åsberg Depression Rating Scale (MADRS) at baseline, midpoint, endpoint, one month, and three months post-treatment. Cognitive performance on n-back and Sternberg working memory tasks was assessed at baseline, endpoint, and three months post-treatment. Participants receiving theta-tACS, but not alpha-tACS, showed significantly higher rates of response (≥50% reduction in MADRS score from baseline) and remission (MADRS score <10) compared to sham at one-month post-treatment. Improvements in depression severity were not associated with changes in cognitive task performance. This study advances the development of mechanistically informed, accessible interventions to improve affective symptoms in young people with depression, while highlighting that cognitive task performance may not always link to clinical outcomes.

Have we solved spatial vision?

William Harrison, University of the Sunshine Coast

Spatial vision is one of the most conserved nervous system functions: it is an ability shared by almost the entire animal kingdom. From insects and fish to birds and mammals, spatial vision is the means by which an organism resolves visual structure in different locations to guide navigation and foraging, as well as more complex functions like recognising potential predators or mates. In mammalian brains, the spatial encoding properties of visual neurons varies as a function of their receptive field locations within the visual field, with more cortical resources devoted to neurons covering foveal regions of space compared with peripheral regions of space. In this presentation I will reveal how the functional architecture of such brain regions can be comprehensively understood from a small set of simple rules. This discovery shows that cortical magnification, pinwheels, anisotropies in perceptual sensitivity and spatial biases are not independent design features, but linked consequences of a single optimisation principle. This neurotheoretical advance helps to unify over a century's worth of empirical knowledge under a single explanatory framework, and provides new, testable predictions about how neural resources are allocated across different species' visual systems.

A word in the hand is worth two in the push: Comparing verbal and manual versions of the arrow-word-Stroop task

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Cognitive inhibition allows automatic responses to be suppressed if they are inappropriate for a given task. The traditional arrow-word Stroop task measures this through slower verbal responses to an arrow direction when there is an overlaid incongruent word (e.g. "LEFT" presented within a right-pointing arrow). However, it remains unclear how response modality (manual or verbal) and attended stimuli (arrow vs. word) influence the magnitude of Stroop interference. Healthy adults (n=32, 18 – 52 years, 22Female) completed two experiments. The first measured manual response times with left and right button presses. The second measured vocal responses when participants said aloud the direction ("left or "right"). Participants completed blocked conditions which varied in stimulus congruency (Pure-blocks; 100% Congruent, 100% Incongruent trials; Mixed-blocks: 70% Congruent /

30% Incongruent trials), and baseline blocks (Arrow-only, Word-only). Manual responses were faster to arrows than words, and incongruent arrows slowed manual responses to the word. Conversely, verbal responses were faster to words compared to arrows, and an incongruent word slowed verbal

responses to the direction of the arrow. Mixed-blocks slowed response times in both experiments, suggesting that mixing congruent and incongruent trials reduces strategic responding and better reflects inhibitory demands than Pure-block designs. These findings suggest additional translation between spatial and language domains elicits greater Stroop interference than within-modality conditions. Further, the manual arrow-word Stroop task is a robust method of assessing cognitive inhibition, with trial-level accuracy, particularly in groups where speech production deficits may confound results on traditional colour-Stroop tasks, such as those with Alzheimer's Disease.

Modulating Metacognition: How Attentional Demands and Task Complexity Shape Confidence Judgements in Perceptual Decision-Making

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The ability to monitor and evaluate one's own cognitive processes, or metacognition, is central to adaptive behaviour and learning. Confidence judgements, a key metacognitive output, provide insight into how individuals evaluate the accuracy of their own decisions and performance. Whilst prior research has focused on metacognitive sensitivity and confidence calibration in simple perceptual tasks, it is relatively unknown how cognitive demands impact metacognition. Specifically, the cognitive and neural mechanisms by which attentional demands and task complexity influence confidence judgements remain poorly understood. In this study, healthy adult human volunteers (N = 36) observed visual displays comprising two peripheral (left and right) patches of moving dots and a coloured central annulus as their brain activity was recorded using electroencephalography (EEG). To manipulate attentional demands, participants were cued to report either the annulus colour, one of the two peripheral motions, or the average motion direction of the two patches. They also rated their confidence about response precision of perceptual judgments. Preliminary behavioural analyses revealed robust effects of cognitive demands with lower confidence for more complex tasks. The EEG analyses will focus on (i) how task demands impact the time- course of feature-specific neural responses to all stimuli (ii) times at which neural measures predict perceptual and metacognitive judgments and (iii) potential dissociations between these time periods. A dissociation between how task demands impact neural correlates of perceptual and metacognitive judgments would suggest that metacognition occurs relatively independently from perception.

Developing an EEG-based biomarker of inner speech

Thomas Whitford, University of New South Wales

Speaking-induced suppression refers to the phenomenon that self-generated speech elicits less activity in the electroencephalogram (EEG) then externally-generated speech. Speaking-induced suppression is typically taken as evidence of a predictive process, likely involving corollary-discharges, in which the brain predicts and dampens the sensory consequences of its own movements. While SIS has typically been investigated in the context of overt speech, recent research has investigated speaking-induced suppression in the context of inner speech. In this talk, I will introduce an experimental paradigm which aims to quantity the integrity of a person's inner speech on the basis of an EEG-based biomarker. I will then present evidence indicating that this EEG marker is sensitive to both the content of a person's inner speech, as well as 'auditory' properties such as its 'loudness'. By providing an objective neurophysiological marker of this purely mental action, this paradigm may facilitate the exploration of the neurophysiological basis of auditory-verbal hallucinations, which have long been hypothesized to arise from abnormalities in inner speech.

Pre-saccadic Mechanisms Support Rapid Face Detection but Are Insensitive to Emotional Expressions

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Facial expressions signalling threat are thought to be recognised before awareness, which may explain our spontaneous gaze shifts towards fearful and angry faces. However, most evidence comes from studies using centrally presented faces, which cannot reflect detection in the periphery before eye movements. We used a modified fast saccadic choice task to test whether the brain can detect peripheral faces pre-saccadically, and whether detection speed depends on facial expression. In Experiment 1, participants (N = 30) viewed pairs of images (one face, one food), each centred 10 DVA to the left and right of central fixation point and were instructed to saccade rapidly to the face or food target (50% trials each). When participants broke fixation, the images disappeared. Face targets were detected faster than food targets, with a small advantage for negative over positive facial expressions. In Experiment 2 (N = 20), participants maintained central fixation while image pairs appeared for 300 ms, then indicated target location via button press. EEG decoding revealed rapid encoding of face target location but not food targets. However, we were unable to reliably decode the difference between fearful face targets and happy face targets. To enhance neural discrimination of facial expressions, Experiment 3 asked participants to judge face valence, yet similar results were yielded as Experiment 2. Overall, these findings indicate that the human brain can detect peripheral faces before eye movements, supporting known face-detection advantages in free viewing, but provide no evidence that pre-saccadic mechanisms are sensitive to facial expression.

Hemispheric Asymmetries in Emotional Face Processing: An EEG MVPA Study

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Emotional faces are processed by a distributed brain network, with notable hemispheric asymmetries. Evidence for rapid threat detection via the right amygdala raises the question of whether one hemisphere engages earlier or more strongly than the other, making temporal dynamics central to understanding emotional face perception. We used electroencephalography (EEG) and multivariate pattern analysis (MVPA) to examine how angry, happy, and neutral faces are represented across the hemispheres over time. Participants (N=40) viewed 96 faces (32 per expression) in a rapid serial visual presentation paradigm, with stimuli presented at 3 Hz centrally or peripherally. Attention was maintained with a concurrent dot-monitoring task. Across 8,640 trials per participant, decoding analyses were applied to posterior electrode clusters separately for each hemisphere and position, yielding onset time, peak time, and peak accuracy. Classifiers reliably distinguished emotional from neutral faces for centrally presented stimuli, demonstrating that emotional content is decodable in both hemispheres when faces are foveated. Decoding patterns varied across hemispheres and expressions, suggesting differential sensitivity to emotional faces. In contrast, peripheral faces carried little emotion information in the EEG signal, aligning with behavioural evidence of poor peripheral emotion sensitivity. Overall, findings shed light on right-hemisphere and threat-related biases in affective face processing, while also revealing stronger decoding for foveal than peripheral presentations and showcasing the value of EEG-based MVPA for tracking temporal dynamics.

How does motion context affect multisensory integration of audiovisual stimuli?

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Cross-modal signals that are aligned in space and time are often integrated in the brain. Akin to unimodal stimuli, the brain

may bind related multisensory features into unified 'objects'. Research reveals that attention prioritises perceptual 'objects', resulting in enhanced detection of all features of a related cluster (inferred as the object). However, aligned multisensory signals may not always be perceived as coming from a single object/source (perhaps a motorbike approaches alongside an electric car in the distance). We assessed whether coherent auditory and visual motion results in cross-modal binding and/or increases the strength of multisensory integration. Specifically, we manipulated the speeds of laterally oscillating dots and tones so that they either moved coherently (perceived as moving together) or incoherently (perceived as moving differently). Observers detected targets (brief luminance and sound level changes) embedded within each stimulus, which were presented either separately or together. We hypothesised that if coherent audiovisual signals were bound into an object, we would observe enhanced target detection and increased integration of bimodal targets (indexed by violations of the race model inequality (RMI)). Surprisingly, we found no differences in target detection and equally robust RMI violations across coherence levels. This may indicate that coherent and incoherent motion contexts are not processed differently by the brain if coherent signals are not perceived as a single object. We are further testing this notion with a follow-up experiment. Our findings have implications for cross-modal alerting systems which may be more effective when signals are perceived as a single perceptual object.

The dynamics of ambiguous image recognition charted with magnetoencephalography (MEG)

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Our visual environments are frequently cluttered, noisy, and sometimes ambiguous. Despite this, we can quickly and effortlessly recognise objects and structure, integrating experience with visual input. Current theories propose roles for rapid feedback from frontal or entorhinal-hippocampal regions, as well as slower feedback from frontal regions. Here, we used MEG to better understand how prior experience informs the perception of ambiguous visual input. We generated stimuli that were very difficult to recognise. For a series of greyscale images, we used a texture synthesis algorithm to create matched foils without recognisable structure but with closely matched statistics. We binarized the original images and their foils, creating 'Mooney' images. In preliminary behavioural testing we identified binarized image pairs that participants could not consistently categorize as real or foils, but which they reliably discriminated after they had seen the greyscale versions. We recorded MEG while participants (n=29) viewed these binarized images and judged whether they were real or foils (baseline), viewed the greyscale images (disambiguation), and reviewed the binarized images (test). We used classification analyses to measure stimulus-related information in occipital and frontal cortices. Compared with baseline, occipital representations of binarized images were robustly different after disambiguation, but this difference emerged quite late (~400-600ms after stimulus onset). Granger causality analyses showed that this difference was preceded by a period of information flow from frontal to occipital cortices which was absent prior to disambiguation. Our findings demonstrate the role of late feedback from frontal regions in shaping visual cortical responses to incorporate prior experience.

Systematic underestimation of e-scooter speed relative to other vehicles

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The increasing prevalence of e-scooter usage on and around urban and suburban roads has been significantly associated with accidents, injuries, and deaths and changed the road-user

mix in multifactorial ways. Navigating roads, particularly when driving, is a complex activity that relies on multiple autonomous and reflexive elements of cognitive processing like object speed perception. The ability to accurately determine the speed of objects in the environment has been theorised to vary based on factors including movement, positioning, size, implied threat, and familiarity.

This study aimed to address the gap in the literature assessing the perception of e-scooter speed against other common road vehicles (trucks, cars, SUVs, motorcycles, ebikes, bicycles) in a naturalistic setting to maximize ecological validity. Based on the small size, minimal implied threat, and novelty of e-scooters, we hypothesized that they would be perceived as slower than all other vehicle types.

Participants viewed consecutive video clips of e-scooters and each other vehicle type across multiple speeds (5-60km/hr in 5km/hr intervals), and completed a two-interval forced choice task where they reported the faster vehicle. Psychometric functions were fitted to participants' responses, and a Point of Subjective Equality (PSE) was calculated for each pairing.

Initial pilot data (N=14) supported the hypothesis: e-scooter speed was underestimated on average compared to all other vehicle types. Further data collection is underway to reach a more appropriate power in the analysis (N=40).

Characterising recognition memory for novel cross-modal associations

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Perception and cognition seem to be scaffolded by associations that humans learn between features and/or objects from different sensory modalities. For example, via one modality, we can access information provided by another modality, such as when we hear the bark of a dog behind us to infer that the animal—and its associated physical characteristics learned via modalities such as vision and touch—is behind us. Surprisingly, our capacity to encode these associations is largely unknown. We addressed this in a single-trial recognition memory paradigm where novel visual objects were synchronously presented with novel sounds (pseudowords or environmental sounds made unfamiliar via various distortions) in a passive exposure phase. Participants were then tested on their ability to recognise the stimuli; on unimodal trials, the stimulus was either old or new, and on bimodal trials, the stimulus was presented in either its original auditory-visual pairing or in a different auditory-visual pairing. Finally, to assess whether incidental cross-modal correspondences between paired sensory features modulated this learning, participants rated the subjective semantic congruence of each pairing from the recognition phase. Just as Shepard (1967) quantified the capacity of human visual recognition memory over 50 years ago, our work characterises humans' capacity for encoding cross-modal associations, which underpins core perceptual abilities such as object recognition.

Investigating the Spatiotemporal Profile of Consciousness using Dynamic Causal Modelling

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Two major theories of consciousness make distinct predictions about the spatiotemporal profile of neural activity that elicits conscious perception. Information Integration Theory (IIT) posits that sustained posterior activity in content-specific networks generates consciousness, whereas Global Neuronal Workspace Theory (GNWT) proposes that a phasic, ignition of a frontoparietal network is necessary for consciousness. Using magnetoencephalography data from the COGITATE consortium, we applied dynamic causal modelling (DCM) to test brain connectivity patterns proposed by either theory. First, source reconstruction was performed to determine peak voxels driven by faces at stimulus onset within six regions of interest - bilateral primary visual cortices, fusiform gyri, and prefrontal cortices. DCMs comprising these regions were fully connected at each level and connectivity parameters were estimated at the group-level via parametric empirical Bayes. To evaluate the temporal profile of connectivity, we modelled evoked responses to task- irrelevant faces in an expanding

time window increasing in steps of 0.1s, starting from onset up to 0.6s post-stimulus offset. Preliminary results from a discovery cohort (n=48) simultaneously challenged and provided partial support for both theories. Specifically, we found sustained activity in posterior connections that was sustained beyond the stimulus offset. Additionally, we saw phasic increases in feedback connectivity at both stimulus onset and offset in some (but not all) of the key connections. While these preliminary findings do not clearly align with either theory, final results will include a validation cohort of 52 additional participants to test the reproducibility of these findings.

Finding the stuff that dreams are made of: Massive feature extraction of NREM EEG data to identify markers of dreaming

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Dreaming is a universal aspect of human experience, yet their underlying neural mechanisms and functions are still not fully understood. Investigating "the stuff that dreams are made of" is made difficult by the fact that dreams are spontaneous and private subjective experiences. Identifying robust markers of dreaming and its contents is crucial for advancing the scientific study of these phenomena. While previous research has made significant progress, it has historically relied on a limited set of analysis methods, resulting in a more restricted and narrow approach to uncovering neural correlates of dreaming. Here, we search for novel markers of dreaming by exploring time-series features in human NREM electroencephalogram (EEG) in an agnostic, bottom-up fashion. Specifically, we will utilise a pre-registration approach with the newly established Dream EEG and Mentation (DREAM) database and conduct highly comparative time-series analysis (hctsa) to test over

7000 univariate time-series features derived from various scientific disciplines. Here, we report the pilot analysis (N=9 , with a total of 54 dream reports and NREM EEG cases) to demonstrate the feasibility of our methodology, assessing all features and establishing our analysis pipeline. We found an initial set of features that significantly discriminate between reports of dreaming and no dreaming. Following the pre-registration, we will test if there exist any time-series features that reliably classify dreamful vs. dreamless reports across 12 standardised DREAM database datasets (343 subjects, 1379 cases).

Tracing the attentional spotlight: Investigating alpha oscillations during a continuous monitoring task

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Neural oscillations within the alpha-band (8-14Hz) have well-established links with attention. For example, spatially-specific, occipito-parietal alpha power preceding a target varies with subsequent behaviour (including accuracy and response speed). It remains unclear how spatial attention is utilised by subjects concurrently monitoring multiple stimuli for intermittent uncued targets that may arise at any stimulus location. We

aimed to better understand how subjects use spatial attention of their own volition to facilitate target detection. We examined the alpha-band activity of 80 participants who completed a random dot motion task, in which two dot patches (one in each visual hemifield) were monitored for a shift from random to coherent motion (the target). Participants maintained fixation centrally and continuous EEG and pupillometry were recorded. We trained a classifier on the post-target alpha-band activity to discriminate when attention (alpha-band activity) was oriented towards the right versus left hemifield. We applied the classifier weights to the pre- target window to test our hypothesis that attention would oscillate between the stimuli as they were monitored for a target. Preliminary results suggest a discernible oscillatory pattern in alpha-indexed spatial attention in the range 1.5-3Hz, that alternates between stimuli in the right and left hemifields during the pre-target window. This suggests a dynamic strategy whereby participants alternate their 'attentional spotlight' back and forth between the two stimuli. This approach can facilitate investigations into how visual attention strategies may vary across tasks with varying target eccentricities and timings, and to understand how these might be altered in clinical populations.

Dissociable Effects of Education and Socioeconomic Factors on Cognition, the Brain, and Resilience to Dementia

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A large body of research has linked educational attainment with increased resilience to cognitive decline in ageing and dementia. However, socioeconomic factors show similar links with neurocognitive health in older adults, and it has been proposed that the benefits of education may be attributed to individual differences in socioeconomic circumstances.

The UK Biobank provides cognition and imaging measures in the largest population cohort studied to date. Here, in over 450,000 individuals, (with neuroimaging data on over 45,000) we test the hypothesis that the association between education and cognitive resilience is dissociable from socioeconomic factors.

We provide converging evidence from behaviour (cognitive assessments), neuroimaging (grey matter volume and white matter microstructure), and clinical risk profiles (subsequent development of dementia) that education and SES exhibit at least partially independent associations with neurocognitive health.

Neuroimaging findings show that while several brain structures vary according to both SES and education (the amygdala, hippocampus, and ventral striatum), education is uniquely associated with altered structural organisation of an extended set of regions (the insula, orbitofrontal cortex, and temporal fusiform cortex). Moreover, education (and not SES) shows unique associations with white matter microstructural organisation in white matter tracts with projections to these grey matter areas, specifically the uncinate, superior longitudinal fasciculus, and posterior thalamic radiation.

These results shed light on mechanisms that may underpin the benefits of education and have implications for policy regarding a role for education that is orthogonal to SES.

Emotion processing in the periphery under suboptimal viewing conditions: An electroencephalography study using a face-crowding paradigm

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Research has shown that threatening faces can be processed unconsciously and capture attention automatically. However, common paradigms such as presenting single faces in foveal vision have limited ecological validity, as real-world situations typically consist of multiple peripheral faces. Face crowding constitutes a valuable method for rendering the target visually unaware while representing the real-world visual conditions. Moreover, face crowding disrupts holistic face integration while preserving lower-level visual features. It can further investigate whether unconscious emotion processing relies on holistic integration or basic visual features. In the present study, EEG/ERP was used to investigate neural responses to fearful and neutral target faces rendered suboptimal by crowding.

Target faces appeared with neutral-face flankers presented at different eccentricities, and the N170 and N2pc components were explored to measure early face encoding and spatial attention allocation. Results showed that viewing at close periphery enhanced both the N170 and N2pc. This confirms more efficient visual processing at close than far eccentricities. However, target facial expressions did not modulate the N170 but only the N2pc. Specifically, fearful faces at the close periphery elicited a stronger N2pc than either fearful faces at the far periphery or neutral faces at the close periphery. Therefore, crowding appeared to inhibit the N170 modulation that is often observed with emotions, especially when viewing from the periphery. In contrast, attentional allocation under such conditions (as revealed by the N2pc) is maintained, suggesting that unconscious processing which leads to attentional attraction relies on the basic visual features of fearful expressions.

PsiConnect: Context-Dependent Brain Dynamics under Psilocybin

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Background: Psilocybin, a serotonergic psychedelic, induces profound alterations in consciousness often experienced as meaningful connection and clarity. While these effects may underpin clinical potential, psychedelic brain dynamics have frequently been characterised as desynchronisation. We refine this view by examining psilocybin's impact using the largest psychedelic neuroimaging dataset to date.

Methods: In an open-label study at Monash Biomedical Imaging, fMRI and EEG were recorded in 60 healthy adults (18–58 years) during multiecho eyes-closed rest, meditation, music, and eyes-open movie viewing scans, before and after 19 mg psilocybin. Mindset measures and validated psychedelic questionnaires were acquired. Alongside conventional analyses and dynamic causal modeling, we used CEBRA (a contrastive-learning method for joint neural–behavioural embeddings) and TAVRNN (Temporal Attention-enhanced Variational Graph Recurrent Neural Network) to characterise brain dynamics across conditions.

Results: Our analyses revealed a structured organisation in brain activity, dependent on experiential context and the intensity of subjective psychedelic effects, and a shift in eyes- open versus eyes-closed states under psilocybin.

Conclusions: Our multimodal approach combining fMRI, EEG, and machine learning provides a comprehensive and revised account of psilocybin's acute effects on brain activity, offering new insight into the neurobiological mechanisms underlying transformative psychedelic experiences and methods for predicting clinically relevant outcomes.

The neural basis of lexical tone in bilingual language processing

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Lexical tone serves as a crucial cue to tonal languages like Mandarin but not in non-tonal languages like English. Research shows that tonal bilinguals (e.g., Mandarin-English) activate tonal information even when it is not used in the target language and task, yet the neural mechanisms underlying this cross-language activation remain unclear. While monolingual studies show tone processing mainly involves left-hemisphere regions, we aimed to examine whether tonal bilinguals engage similar areas when integrating pitch information with syllables in processing L2. Using an auditory oddball paradigm with MEG, we investigated cross-language tone processing in 25 Mandarin–English bilinguals and compared with 21 English monolinguals. Participants listened to English interlingual homophones (IHs) and non-IHs as standards, with the same words superimposed with Mandarin tones as deviants. IHs are words that sound similar across languages but differ in meaning. Collapsing across participant groups, tonal deviations elicited mismatch field (MMF) responses (deviants vs standards) in the

bilateral STG and left MTG, reflecting basic acoustic processing. Compared to monolinguals, bilinguals showed stronger MMFs in the bilateral STG, while the IH effect (greater MMFs for IHs than non-IHs) emerged exclusively in the left STG, suggesting that the right STG supports pitch-pattern processing, whereas the left STG underlies cross-language phonological activation. However, no such effects were observed in the left MTG, a region linked to semantic processing, indicating that semantics did not involve in this activation. Overall, these findings suggest that bilinguals' native phonological systems can be automatically engaged during L2 processing, independent of semantic involvement.

Plasticity in grey and white matter following transcranial ultrasound stimulation

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Transcranial focused ultrasound stimulation (TUS) is a next-generation technology with potential to revolutionise basic and clinical neuroscience research. It is now possible to non-invasively and precisely focus acoustic energy through the human skull to target brain structures that were previously inaccessible. In vitro and in vivo studies indicate that mechanosensitive ion channels are sensitive to ultrasound, including potassium channels located at nodes of Ranvier of myelinated axons. This provides a mechanistic rationale for targeting white matter tracts with TUS. In this talk, I will present results of a within-subject study (n = 15) that used transcranial magnetic stimulation to measure corticospinal tract neurophysiology before and after a 5 Hz patterned TUS intervention. Across three sessions, TUS was targeted at either i) the hand region of left primary motor cortex, ii) the left corticospinal tract at the level of the superior internal capsule, or iii) the homologous tract in the opposite hemisphere. The results demonstrate site specific plasticity, with reduced intracortical inhibition following motor cortex TUS, and for the first time, excitatory plasticity following non-invasive stimulation of white matter in humans. These findings provide causal evidence of white matter plasticity in the human corticospinal tract and establish TUS as a tool for non-invasive neuromodulation in basic and clinical contexts.

Tracking the Cerebellar Cognitive Affective Syndrome: Two- year decline in cognitive performance in spinocerebellar ataxias

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James Morgan, Monash University

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Spinocerebellar ataxias (SCAs) are genetic, neurodegenerative conditions, involving damage to the cerebellum and cerebellar pathways. This leads to progressive movement incoordination. Individuals can also show cognitive difficulties, which may be attributed to the Cerebellar Cognitive Affective Syndrome (CCAS). The CCAS Scale (CCAS-S) is a cognitive assessment which differentiates SCAs from control cohorts, however no longitudinal studies are available. It is crucial to understand cognitive progression in SCAs, to inform clinical management and education. We investigated annual CCAS-S performance in SCA types 1, 2, 3, and 6, and its relationship to patient-reported outcome measures.

Individuals with SCAs and controls were administered the CCAS-S annually for up to two years. Participants with SCAs additionally self-reported their day-to-day cognitive and motor function via the Patient-Reported Outcome Measure of Ataxia.

Amongst 25 individuals with SCAs, significant two-year decline in CCAS-S performance was observed ($p=.003$). Greater decline was associated with better baseline CCAS-S scores ($rs=-0.507$, $p=.01$) and milder baseline ataxia severity (trending; $rs=-0.357$, $p=.08$). There was no difference in one-year CCAS-S change between the SCA ($n=45$) and control ($n=26$) groups. Greater one-year decline on the CCAS-S in SCAs was significantly associated with greater decline in self-reported day-to-day cognitive function ($rs=0.478$, $p=.001$) but not motor function.

The CCAS-S indexes functionally-relevant cognitive decline in SCAs. This decline may be particularly pronounced in early/mild

disease stages. Our results motivate larger, longer- term studies of cognition in SCAs - to investigate cognitive trajectories, identify individuals most at risk of decline, and develop appropriate interventions to maximise quality of life.

Generalisation between motor and episodic sequences: A conceptual replication of Mosha & Robertson (2016)

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Our memories for skills and actions, and for daily events, have been classically considered to be supported by distinct procedural and declarative neural systems. However, there has been increasing behavioural evidence of interactions between these different memory domains. Of note, a study by Mosha & Robertson (2016; Curr. Biol.) reported evidence of

'generalisation' between a motor sequence and a word list learned in succession, with improved learning of the subsequent sequence when both sequences shared an ordinal structure. This striking finding suggests that sequential information may be shared between our different memory systems. However, it was only documented once by the index study, and we aimed to replicate and corroborate this cross-domain generalisation effect. One hundred and twenty-five adult participants (Mean age = 23.65 ± 4.7 years, 32 male) completed a word list task and motor sequence task in counterbalanced order. Two groups completed both tasks with a shared ordinal structure and two groups completed both tasks with different structures. Contrary to expectations, we did not observe facilitated motor sequence or word list learning when both tasks were completed with a shared ordinal structure, relative to different structures (all $p > .05$). Our results challenge the notion of cross-domain generalisation, and highlight the complexity of cross-memory interactions. These findings will be discussed in relation to memory allocation theory of how memory generalisation is supported by overlapping neuronal ensembles.

CHARM-DiGiTAL: Protocol for a personalized digital intervention to improve cognitive outcomes in midlife

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Background: Age-related cognitive decline and physical frailty can reduce independence and quality of life. Yet, many digital health interventions pursue treatment over prevention, targeting older adults and specific health concerns. Recognizing midlife as a critical prevention window, this study describes and evaluates CHARM-DiGiTAL (CHARM Digital Infrastructure for Guidance, Intervention, Tracking, and Learning), a custom digital platform delivering personalized programs to promote healthy longevity and workplace productivity in middle-aged adults. Methods & Results: In a 16-week, block-randomised controlled trial, middle-aged participants with elevated cerebrovascular risk but preserved cognition (n = 135) will be allocated to a waitlist control or the CHARM-DiGiTAL intervention group. The control group will receive usual care. The intervention group will receive neuroeducation and brain-health learning packages, alongside a personalized lifestyle program covering exercise, nutrition, and vascular health monitoring. As CHARM- DiGiTAL will be delivered online and is compatible with wearable technology, fortnightly in- person check-ins will be held to support adherence and address barriers to adoption. The primary outcome is performance on a study-specific global cognitive composite score, comprising tests on executive function, working memory, and the Workplace Ability Index. Secondary outcomes include feasibility, usability, and acceptability of CHARM- DiGiTAL. Discussion: These findings will advance knowledge on digital interventions for promoting brain–body health. We hypothesize that CHARM-DiGiTAL will improve global cognitive composite scores, reflecting gains in executive function, working memory, and workplace ability in the intervention group. We also anticipate CHARM-DiGiTAL to provide a scalable, personalized approach to support healthy aging.

From exposure to impact: Measuring the cognitive effects of trauma in the general population

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Trauma is highly prevalent in the general population and increasingly recognised as impacting cognition beyond clinical groups. Research suggests working memory (WM) and reinforcement learning processes (RL) operate in parallel, with WM dominating under low memory load and RL under high load. Trauma exposure has been linked to reduced WM capacity and flexibility, while RL may also be disrupted, showing heightened sensitivity to negative feedback, and more habitual responding. Yet the combined influence of trauma on WM–RL dynamics remains underexplored in non-clinical populations. This study investigates whether trauma exposure—in particular trauma with ongoing impacts—affects WM and RL performance in healthy adults. Participants will complete the Life Experiences and Stressors Scale (LESS), a low-risk adaptation of the Life Events Checklist, and the Impact of Event Scale–Revised (IES-R) to assess trauma-related symptoms. Cognitive performance will then be measured using a sequential decision-making task adapted from Elrich et al. (2025). Across 12 blocks, participants learn stimulus–response associations through feedback under varying WM demands (set sizes 2, 3, 5, 6). Performance metrics include accuracy, trials to criterion, and learning slope. It is expected that individuals with trauma exposure and ongoing impacts will show poorer performance across both WM- and RL-biased conditions, with steeper decline under high load conditions. Participants with trauma but no lasting impacts are hypothesised to perform more like healthy participants, but with mixed task performance reflecting cognitive heterogeneity. Regression analyses will examine trauma exposure and symptoms as continuous predictors, while computational modelling will further characterise mechanisms underlying learning differences.

Exploring models of learning and action: the Generalised Hierarchical Gaussian Filter

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Predictive coding is now a familiar concept in the literature, but it represents only one side of the coin. In this framework, agents (or the brain) minimise prediction errors by updating their internal generative model, thus engaging in perceptual inference.

The other side of the coin is active inference, the natural corollary to perceptual inference. Here, agents rely on their prior preferences and action policies to predict which future actions will best minimise expected prediction errors, effectively fulfilling the hypothesis.

The Hierarchical Gaussian Filter (HGF) has been used to capture learning under uncertainty through perceptual inference. Recently, however, this framework has been extended and reformulated into a more general, network-based form: the Generalised Hierarchical Gaussian Filter (GHGF). This extension conceptualises inference—whether active or perceptual—as a distributed network of nodes coupled in different ways. The result is a modelling process that is simpler and more extensible. In our work, we will apply this framework across two paradigms, the first a predictive discrete-choice task, comparing choices based on leptokurtic versus Gaussian distributions and the second, a continuous motor-tracking task.

Through these examples, we will highlight the advantages of incorporating active inference into task modelling. Using a combination of model comparison, parameter recovery and reliability analyses, demonstrating how such modelling can better capture behavioural choices than models based on perceptual inference alone. Finally, we will offer practical guidance for applying the GHGF in modelling studies.

Interactions between stimulus congruence and expectancy challenge two-stage models of action cancellation

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While action cancellation is thought to be underpinned by specialised inhibitory networks, a growing body of research posits that a generalised inhibitory response also occurs upon attentional capture of unexpected stimuli. This has contributed to what is known as the pause-then-cancel (serial) model of action cancellation: a fast (non-specific) pause process and a subsequent, slower, cancel process that inhibits basal ganglia (and thus, motor) output.

Here we describe two complementary experiments (n=50, 18-35 years) designed to tease apart the purported pause process from action cancellation. Using flanker arrows as the unexpected stimuli, we postulated that the robust expected congruency effects of flankers should disappear if the flankers appeared unexpectedly and thus triggered a generic unconscious pause process. Across the experiments, participants undertook a choice RT, a flanker task with flankers on every trial or only on 1/3 trials (infrequent flankers), a stop signal task (SST) and an SST where flankers appeared alongside the stop signal (1/3 of all trials).

Using a Linear Mixed Model approach, we observed interactions between flanker expectedness and congruency in response choice trials, with greater RT slowing to incongruent infrequent flankers (but not infrequent congruent or infrequent neutral flankers). When infrequent flankers were presented after the imperative stimulus, RT differences were abolished, indicating the flanker is affecting response selection, not response execution. Flankers appearing with a stop signal improved stopping speed, although was only significant for incongruent flankers. The current results challenge the pause-then-cancel framework and will be discussed in relation to both action execution and inhibition.

A novel odd-one-out task reveals super-recognisers spontaneously and preferentially process face-identity information

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Super-recognisers are individuals with an exceptional ability to recognise and remember faces. They have been predominantly studied via tasks that explicitly direct attention to face-identity (e.g., the Cambridge Face Memory Task). However, it is unclear whether SRs preferentially prioritise identity over other face information (e.g., expression). Here we explored this by having 37 super-recognisers and 92 typical-recogniser controls complete a novel "odd-one-out" task that instructed them to select which of three faces on each trial was most visually distinct from the others. Within the trio (A1, A2, B1), two faces were the same identity (A1_A2), two had similar valence (A1_B1), and two had similar viewpoints (A2_B1). No face pair closely shared more than one attribute. In this design, selecting any one face as distinct implicitly endorses the attribute shared by the remaining two as most salient on that trial. We found that while both groups endorsed identity significantly more than valence or viewpoint, super-recognisers did so to a notably greater extent than controls. Within each group, individuals' tendency to endorse face-identity was also positively correlated with their performance on well-established explicit measures of face recognition. These results suggest that super-recognisers may spontaneously prioritise information about face-identity over other face dimensions, independently of task demands. Moreover, our data suggests this tendency may be associated with face recognition ability as measured by existing face recognition tests. Finally, our data highlights the potential of

the novel odd-one-out task as an implicit means of capturing individual differences in sensitivity to face-identity information.

Changing the "game": the impact of "serious games"-based cognitive training on cognitive function in Parkinson's disease

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Parkinson's disease (PD) is associated with a significant risk of cognitive impairment, with approximately 26% of individuals with PD developing dementia within five years of diagnosis. Cognitive training (CT) has shown promise in maintaining cognition; however, traditional methods rely on fine motor skills, limiting accessibility for individuals with motor difficulties. Additionally, diminished reward sensitivity and heightened apathy pose an obstacle for individuals with PD to engage with CT. Thus, we evaluated the impact of NeuroOrb, an accessible "Serious Gaming" computerised CT platform, on cognitive function, mood and quality of life in individuals with PD. 50 individuals with PD (33 male/17 female, average disease duration = 6 years) were randomly assigned to the NeuroOrb (n=25), or CogCafe (puzzle-based activities (n=25)) group. Participants engaged with their assigned intervention for three hours per week over six weeks. Cognitive function was assessed pre- and post-intervention, and again at six-months, using a comprehensive battery of assessments. No statistically significant improvements in cognitive function were observed between the NeuroOrb and CogCafe groups at six-weeks or six-months post- intervention. However, baseline testing revealed that the NeuroOrb group showed more significant deficits in attention and working memory than the CogCafe group (p=0.01), indicating they improved to a greater degree, with further analyses underway. Overall, NeuroOrb was considered an accessible and engaging platform, which is important given that motor difficulties and apathy can impact engagement with traditional CT modalities. Combining such CT tools with adjunct interventions, such as neurostimulation, may enhance cognitive outcomes.

Which house, dog, or car is this? A neural and behavioural investigation of visual recognition abilities in Typical- and Super-Recognisers beyond faces

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Super-Recognisers (SRs) provide a unique test case for understanding the limits of human recognition ability. While they are defined by superior face memory, it remains debated whether the SR advantage also extends to other visual categories. To address this gap, we designed an EEG neural decoding study to probe behavioural and neural distinctions between SRs and Typical-Recognisers across four categories (faces, cars, dogs, houses). In Phase 1, participants viewed a rapid stream of images containing 10 images of 10 different exemplars within each category, each presented 16 times. Phase 2 was a surprise Two- Alternative Forced Choice recognition memory test, in which participants had to distinguish both novel and previously-seen images of Phase 1 exemplars from foils. We recorded 64 channel EEG during both phases to enable direct comparison of neural responses associated with encoding and retrieval for each category. Using multivariate pattern analysis,

we decoded the 10 individual identities within each category from one another (e.g., car 1 vs. car 2 vs. car 3…) and found evidence for identity-level representations within each category. Preliminary results provided minimal evidence that identity decoding (for any category) differed between SRs and typical-recognisers, but SRs did demonstrate an overall behavioural advantage, specifically for faces and dogs, and – unlike typical-recognisers – their accuracy did not drop for novel items. These findings offer an initial framework for investigating how exceptional recognition ability may be reflected in the brain and highlight the need for further research to disentangle domain-specific versus general memory effects.

Has Stopping Stopped Making Sense? A Critical Interpretation of Complex Action Cancellation Paradigms

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Action cancellation represents a fundamental aspect of human motor control. In recent years, advancing theoretical accounts of this process have motivated increasingly complicated behavioural paradigms. Drawing on both recently published and unpublished results, we provide an accessible overview of commonly implemented "complex" stopping tasks, selected on the basis of their relevance to ongoing debates regarding the neural underpinnings of action cancellation.

Notably, much of the past research assessing performance in these tasks uses methods for estimating stopping speed that were developed for "simple" stopping tasks. While these methods are convenient, in that they allow for estimations of stopping speed using behavioural data alone, there are fundamental questions regarding their validity in more complex paradigms. We describe observations made using electromyography-based measures of stopping speed which, across numerous experimental contexts, fail to align with past research using traditional behavioural measures. We believe the lack of consistent methodologies, both in terms of how stopping speed is determined, and how experiments are implemented, is a current fundamental challenge for this field of cognitive neuroscience.

The discussion we present aligns with an upcoming narrative review on these topics. We conclude that there is currently a need for within-subject comparisons across complex stopping tasks, employing contemporary (and neurophysiological) indices of action cancellation. While these tasks are often purported to have increased ecological validity, the high levels of heterogeneity in task design, and current lack of well-controlled comparisons between tasks, means the literature risks extensive task-specific findings that fail to generalise between laboratories, and beyond the laboratory.

Adaptive shifts in amygdala–hippocampal theta coupling govern aversive learning and extinction

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Adaptive behaviour relies on the flexible encoding and suppression of aversive associations. Dynamic coordination between the amygdala and the hippocampus form key regions governing these functions. Yet, the spectral and directional mechanisms underlying these processes in humans remain poorly understood with evidence from direct human neuronal recordings especially scarce. Using intracranial EEG recordings from the amygdala and the hippocampus acquired during a two-day aversive learning and extinction task, we identified frequency-specific shifts: amygdala theta (3–8 Hz) and gamma (30–45 Hz) power increased during conditioning and decreased during extinction, while hippocampal alpha and gamma activity shifted to theta and gamma during extinction. Directional phase connectivity results showed frequency-specific reversals: amygdala-to-hippocampus dominance at 3-5 Hz during conditioning and hippocampus-to-amygdala predominance in extinction, while the opposite pattern was found at 6-8 Hz, a reconfiguration validated by computational modelling. These findings uncover distinct theta sub-bands coordinating dynamic, bidirectional communication in the human amygdala–hippocampal circuit, elucidating a neural mechanism for the flexible regulation of emotional memory.

Treatment-refractory anxiety disorders: Altered activity and connectivity with emotional stimuli

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Anxiety disorders are the most common mental health conditions, with a lifetime prevalence of 24.9% in Aotearoa New Zealand. Many individuals do not respond to first-line treatments, however the underlying basis of treatment-refractory anxiety (TRA) remains unclear and effective treatments are lacking. Functional magnetic resonance imaging (fMRI) can be used to investigate neural activity and 'functional connectivity' (i.e., communication) of brain areas. Critically, the amygdala is a region strongly implicated in anxiety as it is involved in signalling emotionally salient events, fear processing, and emotional regulation. This study aimed to investigate differences in brain regional activity and amygdala functional connectivity between TRA (n = 23) and healthy controls (HC; n = 17) in response to passive perception of emotional faces (fearful, happy, or neutral expressions), using scans collected on a 3 Tesla MRI scanner. Following image preprocessing with fMRIPrep, task-based activity and psychophysiological interaction analyses were performed with the Oxford Centre for Functional Magnetic Resonance of the Brain Software Library. Compared to HC, TRA displayed greater activity in the left superior parietal lobule, left supramarginal gyrus, and left postcentral gyrus with neutral faces. TRA also displayed reduced amygdala connectivity with the right angular gyrus and left prefrontal cortex with fearful faces when compared to HC. These findings provide preliminary insights into potential neural alterations associated with TRA. They will also be used to support further analyses assessing alterations at rest and the effects of a possible novel ketamine treatment option for TRA on these neural profiles.

Alpha oscillations in visual cortex produce anti-Bayesian perceptual biases

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When judging the orientation of tilted lines, observers reports are often biased away from the horizontal and vertical axes that dominate the visual environment. These anti-Bayesian percepts can be explained theoretically by efficient neural codes that allocate resources to maximise the mutual information between neural responses and the stimulus prior. Although, the functional neural basis of these effects has not yet been explored empirically. We hypothesised that cortical alpha-band oscillations (~8-14 Hz) would increase the bias of perceptual estimates by modulating the excitability of neural populations that encode a stimulus likelihood. We report from 25 observers who viewed brief oriented stimuli presented during real-time neural analysis to target states of high or low endogenous EEG alpha power. Consistent with alpha's known inhibitory influence on neural processing, we found that reported orientations were less precise and indeed further repulsed from cardinal axes for stimuli presented during high alpha power. We also found that alpha power decreased subjective reports of stimulus visibility, and that this was cyclically modulated by prestimulus oscillatory phase. We model these results with a spiking neural population code that is efficiently tuned to the over-representation of cardinal orientations. Injecting inhibitory oscillations within the network alters a Bayesian population decoder in a manner consistent with our empirical findings. Specifically, a suppressive mechanism that acts via divisive normalisation results in both increasingly biased orientation read-outs and greater uncertainty within the spike-based neural code. Our results provide computational insight into how alpha oscillations modulate visual neural codes and bias perceptual reports.

Time-Dependent Facilitation of Homologous Actions

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Unimanual actions can facilitate or interfere with similar actions performed with the contralateral limb, especially when in close temporal proximity. Across three sequential button-press experiments, we tested how effector homology – anatomical similarity between fingers – and temporal delay between actions shape these effects. Compared with unimanual simple reaction times (RTs), we examined whether a priming action altered the RT of a subsequent action. We indexed slowing and quickening of the second action's RT as interference and facilitation, respectively.

Priming with a homologous action (e.g., index-index) produced interference at short intervals (≤200ms) but reliably transitioned to facilitation at longer intervals (≥400ms). Priming with non-homologous actions (e.g., little finger-index) also produced interference at short intervals, but never transitioned to facilitation. Critically, these patterns emerged whether the priming actions were performed across hands, or confined to one hand, indicating that facilitation and interference do not depend on interhemispheric dynamics.

Our results reveal a previously undocumented time-dependent facilitation specific to homologous actions, challenging models that attribute parallel-action costs to competitive interhemispheric dynamics. We propose that facilitation and interference flexibly coexist, and are shaped by effector homology and timing. These findings extend current models of bimanual coordination and highlight new opportunities for enhancing motor performance and neurorehabilitation.

Neural Correlates of Chanting: A Systematic Review

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Chanting is an ancient and globally widespread ritualistic practice involving rhythmic vocalization or repetition of words, phrases, or sounds. While previous reviews have considered the neurophysiological impact of meditation and spirituality, chanting has received limited systematic investigation. This review aimed to identify and synthesize neural correlates of chanting, examine methodological variability, and determine consistent neural patterns across chanting studies and styles. PsycINFO and PubMed databases were systematically searched for neuroimaging studies including chanting, mantra, and repetitive prayer. Articles published through October 8, 2024, were included, yielding 899 initial articles. After applying exclusion criteria, 24 studies were included. Study quality was assessed using the adapted Effective Public Health Practice Project (EPHPP) criteria. Findings demonstrate that chanting activates brain regions involved in attention and emotional regulation, including the prefrontal cortex, insula, and cingulate gyrus. Deactivation of default mode network areas, particularly the posterior cingulate cortex and hippocampus, was also observed, suggesting reduced self-referential thought. EEG studies revealed increased theta activity, indicating enhanced relaxation during chanting. Although heterogeneity in sample sizes, imaging modalities, participant characteristics, and control conditions preclude a formal meta-analysis, the findings lay a foundation for advancing research into the neural mechanisms of chanting. Chanting engages neural networks associated with attention and emotional regulation, supporting its potential as a therapeutic intervention. The consistent pattern of prefrontal activation and default mode network deactivation suggests mechanisms similar to other contemplative practices.

Investigating the role of beta oscillations in the rapid consolidation of implicit motor sequences

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Motor sequence learning relies on both online learning during active practice and offline consolidation. Recent work has shown that consolidation occurs rapidly across seconds during short breaks in practice, a process termed "micro-consolidation" (Bönstrup et al.,

2019). While beta oscillations are implicated in motor consolidation over longer timescales (hours to days) (Dayan & Cohen, 2011; Dyck & Klaes, 2024), their role in rapid, micro-scale consolidation of implicit motor skills remains unclear. We investigated whether beta oscillatory activity is associated with micro-consolidation of an implicit motor sequence task. Seventy-two healthy young adults (40 female; age 18–35) performed 24 blocks of a serial reaction time task with their non-dominant left hand while concurrent EEG was recorded. Each block alternated between a 10 second practice period and 10 seconds of rest. Significant improvement in keypresses per second was observed across the training period ($p < .001$, Cohen's $d = 2.35$). This learning was primarily attributable to micro-offline gains occurring during rest ($p = .029$, Cohen's $d = .64$). Event-related spectral perturbation (ERSP) analysis revealed a widespread beta power desynchronisation during task practice that recovered during rest ($p < .001$, Cohen's $d = 1.90$). An inverse relationship between micro-offline beta power and early micro-offline learning was also observed across a frontal- central topography ($p < .05$). Our findings provide evidence implicating beta oscillations in the rapid micro-scale consolidation of implicit motor sequences. Further research is required to establish the causal role of beta oscillations in early skill learning.

Exploring rural-urban differences in modifiable dementia risk factors and cognitive performance in older Australians

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Despite growing evidence that dementia risk can be reduced through preventive strategies, rural populations often face unique challenges that may increase their vulnerability to modifiable dementia risk factors. However, the extent to which these risk factors vary between rural and urban communities remains unclear. This cross-sectional study examined rural-urban differences in modifiable dementia risk factors and cognitive performance in Australian older adults.

We analysed data from 262 participants (82 rural, ~68 years) as part of a larger cohort study. Dementia risk was assessed using the Australian National University Alzheimer's Disease Risk Index (ANU-ADRI), while cognition was measured using Addenbrooke's Cognitive Examination III (ACE-III). Rural-urban classification was based on the Modified Monash Model.

T-tests and Fisher's exact tests revealed significant rural-urban differences in dementia risk and cognitive performance, whereby rural residents had higher dementia risk ($M = -0.83$ vs.

-5.41; $t(255) = -4.35$; $p < .001$) and scored lower on the ACE-III ($M = 93.05$ vs. 94.94; $t(255) = -3.63$; $p < .001$). Linear regression revealed that higher dementia risk was associated with lower cognitive performance ($\beta = -0.13$, $p = .002$), independent of rurality.

These findings reveal important rural-urban differences in modifiable dementia risk factors and cognitive performance among older Australians. The consistent relationship between risk factors and cognition across settings suggests prevention strategies may be effective for both groups, though higher rural risk scores indicate a need for targeted interventions.

Exploring the nexus of lifestyle, education, and social factors: A systematic review of cognitive resilience via biomarkers

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Background: Dementia is a major global health challenge. Central to delaying cognitive decline is cognitive resilience (CRi), the capacity to sustain cognitive function despite brain pathology. CRi is often bolstered by cognitive reserve (CR), which develops through education, occupation, lifestyle, and social engagement. Midlife is increasingly recognised as critical for strengthening these protective factors, yet most research focused on older adults. Understanding how education, lifestyle, and social engagement relate to biomarkers of brain health in midlife remains limited. This review examines these associations in adults aged thirty to sixty.

Methods: We searched MEDLINE, PubMed, and Web of Science up to March 2025 for studies linking educational, lifestyle, and social factors with neuroimaging, blood-based, and genetic biomarkers of CR and CRi. Eleven studies from diverse populations met the inclusion criteria.

Results: Higher education and occupational status were associated with increased grey matter volume and more efficient brain activation. Higher physical activity correlated with lower amyloid and tau levels, reduced alpha-synuclein, and higher antioxidant capacity. Better sleep quality and duration preserved cortical thickness. Combined healthy lifestyle factors related to larger subcortical volumes in people at risk of Alzheimer's. Personality traits such as conscientiousness and openness, alongside exercise, further supported CRi.

Discussion: These findings indicate that modifiable life experiences shape neurobiological pathways central to CR and CRi in midlife. They highlight the importance of integrated educational, lifestyle, and social interventions to promote brain health and prevent dementia before pathology advances.

Funding: Ministry of Education, Singapore - Science of Learning, A1 (MOE-000501-00) Nanyang Technological University - Research Scholarship

A novel saccade-based spatial working memory task in marmoset monkeys

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Saccade-based working memory (WM) tasks provide insights into how visuospatial information is transformed into a working memory. Traditionally, saccade-based WM tasks temporally

isolate the encoding, maintenance, and retrieval stages of WM, and limit memory load to a single item. To study a more ecologically valid task that captures the dynamic, multi-item demands of everyday WM, we developed a novel spatial delayed recognition span task requiring subjects to update and increase WM load as the trial progresses. Subjects were presented with a single abstract shape target on a screen. A correct saccade to the target triggered a one-second delay with no targets present, followed by the presentation of the prior target plus one new target in a novel location. Subjects were required to saccade to the novel target. This continued until reaching the maximum target limit or an incorrect saccade ended the trial. We trained one marmoset monkey to perform the task. The marmoset's proportion of correct choices in the task was above chance for up to two targets ($p < 0.05$, t-test), but not three targets ($p=0.45$), indicating a WM capacity limit. Response times for correct choices were faster under low WM load (1 target, median 170.5ms) and slowed as WM load increased (3 targets, median 410.8ms, $p<0.0001$). Additionally, we collected data from two humans. Performance and saccade reaction time trends were comparable to the marmoset, suggesting translatability across species. The task's dynamic, multi-item design will enable detailed investigation of neural circuits underlying visuospatial WM in marmosets and humans.

Combining cognitive training and intermittent theta burst stimulation to improve cognition in mild cognitive impairment: A pilot randomised controlled trial

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Mild cognitive impairment (MCI) is a transitional stage between healthy ageing and dementia, marked by declines in cognition while daily activities remain largely preserved. It affects up to 35% of adults over 70 and is associated with a 15–18% annual risk of progression to dementia. Cognitive training (CT) has shown promise in supporting cognition in MCI, yet its efficacy is variable and transfer to real-world function remains limited. Intermittent theta burst stimulation (iTBS), a form of non-invasive brain stimulation targeting the dorsolateral prefrontal cortex (DLPFC), can enhance neuroplasticity and may prime the brain to respond more effectively to training. Few studies, however, have examined the combined effects of iTBS and CT in MCI.

This 18-week, randomised, double-blind, sham-controlled pilot trial will recruit 65 individuals with MCI, randomised to CT + iTBS, CT + sham iTBS, or waitlist control. The intervention comprises 14 training sessions over 10 weeks and 5 consecutive days of iTBS delivered at 75% of resting motor threshold to the left DLPFC. Sham iTBS follows the same protocol with a reversed coil position. Primary outcomes include verbal and visuospatial memory, with secondary outcomes assessing executive function, psychological well-being, and activities of daily living. Neurophysiological outcomes include EEG event-related potentials and TMS markers of cortical excitability and inhibition.

This study is among the first to test the feasibility and potential efficacy of combining CT with iTBS in MCI. Findings will inform larger trials and contribute to the development of non-pharmacological approaches to delay dementia progression.

Resting-state GABA and glutamate concentrations are correlated across brain areas involved in executive function: Evidence from 7T magnetic resonance spectroscopy

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Effective information processing involves the synnchronous and coordinated activation of distributed neural populations spanning the cerebral cortex, rather than focal activity within isolated cortical areas. While the exact mechanisms underlying these large-scale activation patterns remain unclear, the neurochemical regulation of excitation and inhibition may be crucial. Magnetic resonance spectroscopy (MRS) provides a means of investigating this possibility by enabling the non-invasive quantification of in-vivo excitatory and inhibitory neurotransmitter concentrations. However, prior research has largely focused on quantifying excitation and/or inhibition within single regions of interest, severely constraining inferences about the role of neural excitation and inhibition in brain function. In this pre-registered study, we investigate the degree to which the intrinsic regulation of excitation and inhibition are coupled across the brain. Eighty subjects underwent a comprehensive magnetic resonance spectroscopy protocol assessing task-free glutamate and GABA concentrations across nine key brain areas involved in cognitive control. Controlling for covariates such as participant demographics, acquisition quality and tissue volume, Bayesian analyses revealed robust correlations in resting-state glutamate and GABA concentrations across prefrontal, motor, parietal, visual and subcortical regions of interest. These associations were found between structurally-related regions (e.g. left and right prefrontal cortex) and functionally-related regions (e.g. prefrontal cortex and intraparietal sulcus). Conversely, glutamate and GABA concentrations were not correlated between functionally distinct regions (e.g. prefrontal cortex and visual cortex). How these findings relate to prior research and inform current theories of cortical function and organisation will be discussed.

Do We Experience Our Entire Perceptual Field as Temporally Bound?

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Our visual experiences appear to present all sensory features across the visual field—whether foveal or peripheral—as temporally bound in a unified present and are often described as being unified in this way. However, empirical evidence strongly suggests that our ability to report and discriminate temporal relations across the visual field is constrained by attentional capacities, with some researchers suggesting that attention is necessary for temporal binding. This creates the following tension: how can our phenomenology of the present appear globally temporally bound if our capacity for temporal binding is limited by attention?

I investigate this tension by exploring two competing hypotheses concerning how the experiential richness of temporal binding may depend on attention:

H1. Our phenomenology of temporal binding is rich across the entire visual field and overflows our limited perceptual discriminatory capacities, because only the latter are attention-dependent.

H2. Both our phenomenology and our capacities for temporal binding are attention- dependent, and the reason we describe our experience of temporal binding as appearing rich and global is due to systematic subjective inflations of our phenomenology.

In this paper, I outline a framework for empirically testing these two hypotheses by investigating three questions: (1) How does our phenomenology of temporal binding depend on attention? (2) Is there a discrepancy between how our phenomenology and our discriminatory capacities depend on attention? (3) If there are such discrepancies, what explains them? For each of these questions, I set out empirically testable hypotheses as well as animations that can be used to evaluate them.

Lithium chloride enhances memory and neuronal survival through Nrf2 signaling in Alzheimer disease model mice

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Alzheimer disease is characterized by the accumulation of amyloid peptide in the brain, which contributes to neuronal damage through oxidative stress. This study examined whether lithium chloride can protect against amyloid related cognitive decline and the molecular pathways involved. Amyloid peptide was infused into the lateral ventricle of Sprague Dawley rats, followed by behavioral evaluation using passive avoidance and fear conditioning paradigms. Animals receiving amyloid showed reduced latency to avoid the dark chamber and diminished freezing responses, while lithium treatment restored both measures in a dose dependent manner. In addition, transgenic mice expressing the Swedish amyloid precursor protein mutation displayed memory deficits in Y maze and Morris water maze tests, which were ameliorated by oral lithium. To explore the underlying mechanism, indices of antioxidant defense were investigated. Lithium administration increased expression of heme oxygenase 1 and gamma glutamylcysteine ligase, accompanied by enhanced phosphorylation and DNA binding activity of nuclear factor erythroid 2 related factor 2. These effects appear to involve upstream kinase signaling cascades that regulate antioxidant response pathways. Collectively, the findings demonstrate that lithium chloride enhances cognitive performance and neuronal resilience by activating nuclear factor erythroid 2 related factor 2 signaling. Such actions highlight lithium as a potential therapeutic candidate for the prevention or treatment of Alzheimer related cognitive impairment.

Temporal Dynamics of Depression in Premanifest Huntington's Disease: A Network Dysconnection Approach

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Depression emerges years before motor signs in premanifest Huntington's disease gene expansion carriers (HDGECs), and is linked to striatal and default mode network (DMN) regions. Previous findings suggested posterior DMN as the driver of depression for HDGECs, with functional reorganisation of right DMN. How these directional connectivity patterns evolve over time and relate to depression trajectories remains unknown.

The study included 105 HDGECs (53 Females, Mage = 43) from TrackOn-HD. Here, we applied spectral dynamic causal modelling to examine effective connectivity changes over 24 months, alongside voxel-based morphometry of grey matter and linear mixed models of depressive symptoms. ROIs were constrained to DMN hubs of posterior cingulate, medial prefrontal cortex, and bilateral hippocampus, as well as striatal regions of bilateral caudate and putamen.

Depression-related network dysconnection operated independently of grey matter atrophy, exhibiting widespread striatal volume loss but no differential atrophy patterns associated with depression. Larger posterior cingulate volumes predicted increased depression severity in people with depression history (Fig. 1), across BDI-II ($p = .041$) and HADS-D ($p = .002$). HDGECs with depression history showed widespread interhemispheric alterations including progressive disinhibition of striatal-DMN circuits, while those without depression exhibited more focal dysconnection (Fig. 2).

Findings suggest depression for HDGECs emerges through network dysconnection operating independently of regional atrophy. Increased PCC volume in association with depression symptom severity for HDGECs with depression history may represent functional reorganisation. Our findings reveal functional network reorganization in relatively preserved regions (hippocampus, PCC) drives depression vulnerability in premanifest HD.

Anauralia & aphantasia: Prevalence and distinct associations with personality, well-being and self-regulation in a large, representative sample

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Prevalence rates and psychological correlates of anauralia (absence of auditory imagery) and aphantasia were examined in a large and representative sample (N=32,784), by presenting two questions about sensory imagery in the 13th wave of the New Zealand Attitudes and Values Study (NZAVS). The single auditory and visual items employed showed excellent concordance with multi-item imagery questionnaires (Plymouth Sensory Imagery Questionnaire, VVIQ) and revealed closely similar prevalence rates for anauralia and aphantasia (0.8%), with the latter showing excellent agreement with earlier estimates of aphantasia prevalence. Importantly, anauralia and aphantasia were associated with distinct psychological profiles. Anauralia, but not aphantasia, was associated with higher conscientiousness and contrary to our initial hypothesis anauralics reported better self- control, including superior control of health-related behaviours compared with individuals who experience typical auditory imagery. Aphantasics, but not anauralics, reported: higher levels of perfectionism and psychological distress; poorer wellbeing; lower self-esteem; and stronger feelings of being an outsider compared to participants reporting typical visual imagery. The latter comparisons of anauralic and aphantasic participants with those reporting typical imagery were highly reliable but relatively small in size (Glass's delta = 0.2 – 0.3). Implications of these findings are discussed.

A neural correlate of evidence accumulation during dietary decisions

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We make decisions about food every day, yet the neural mechanisms that underlie our decision-making capacities are not fully understood. Dietary decisions, such as choosing whether to eat an apple, involve the integration of mnemonic representations related to our preferences and goals as well as sensory information. By comparison, perceptual decisions, such as determining the colour of an apple, primarily rely on sensory information alone. During perceptual decisions, it has been proposed that we accumulate evidence for each decision option until a threshold for one of the options is reached. The centroparietal positivity (CPP), an event-related potential (ERP) component that ramps up and peaks around the time of the response, is posited to be a neural correlate of this evidence accumulation process. However, it is unclear whether the CPP is observed for dietary decisions. We aimed to test for similar neural correlates of evidence accumulation during dietary decisions. Participants (N = 110) completed a speeded food categorisation task. They viewed and evaluated foods while we recorded brain activity using electroencephalography. Examination of parietal ERP waveforms revealed that a) amplitudes peaked around the time of the response, and b) faster responses, indicating a faster build-up of evidence, were associated with steeper ERP slopes preceding the response, congruent with the characteristics of the CPP. This suggests that CPP may track evidence accumulation in dietary decisions. Our findings support the notion of shared decision-making processes in the brain, which are similar across decision types that rely on different sources of information.

Tracing the neural trajectories of evidence accumulation processes during voluntary decisions

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Voluntary decisions are endogenously driven choices guided by subjective goals and personal preferences. While fMRI studies

have identified brain regions involved in voluntary decision-making, the temporal dynamics of how these decisions unfold remain unclear. A key question is whether neural signatures of decision evidence accumulation, previously established in perceptual, value-based, and recognition memory tasks, also arise during the formation of voluntary decisions. Using electroencephalography, we examined whether three response-aligned signals including the centro-parietal positivity (CPP), the readiness potential (RP), and mu/beta (MB) band oscillations exhibited hallmark characteristics of decision evidence accumulation trajectories. These include an accumulation to a fixed threshold and build-up rates that scale inversely with response times (RTs). Forty-nine participants completed a colour decision task with voluntary (two options) and forced (one option) trials. We examined whether pre-response amplitudes and build-up slopes of the three signals varied as a function of RT for voluntary and forced decisions separately. For both types of decisions, the CPP and MB activity showed canonical evidence accumulation dynamics: steeper build-up slopes with faster RTs and pre-response amplitudes invariant to RTs, consistent with accumulation to a fixed threshold. In contrast, the RP did not show evidence for slope nor amplitude modulation by RT. These findings suggest that the CPP and MB activity are domain-general neural correlates of evidence accumulation, extending beyond stimulus-driven tasks to voluntary decisions. By contrast, the RP did not reflect decision-variable dynamics, and may index general motor readiness that is not directly shaped by decision timing.

Resting-State Quantitative EEG Changes Associated with Cognitive Decline in Parkinson's Disease: A Systematic Review

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Cognitive decline is a common and disabling symptom of Parkinson's disease (PD). PD phenotypes vary considerably, however, and current research is increasingly focused on identifying reliable biomarkers that can differentiate patients at risk for cognitive deterioration from those likely to exhibit cognitive stability. Electroencephalography (EEG) is a non-invasive method to measure brain activity, and recent advancements in analytic approaches have provided novel insight into physiological changes associated with PD progression. The present review, thus, summarises findings published within the last decade on the utility of resting-state quantitative EEG measures as candidate biomarkers for cognitive trajectory in PD. Sixty-seven studies were retrieved through PubMed and Scopus for inclusion. Consistent with the general findings of the most recent review on the topic, dated 2016, a widespread shift toward slower oscillatory activity was largely observed in cases of cognitive decline, as well as elevated inter- and intra-network functional connectivity in slow frequency bands. Notably, emerging machine learning studies found that both spectral and connectivity measures—particularly in the theta and delta bands—showed promise as features in model classification and prediction of cognitive status. Nascent microstate analyses showed consistent alterations in class C dynamics among cognitively impaired patients, while source localisation yielded more variable but spatially valuable results. Overall, research integrating quantitative EEG biomarkers with clinical data has the potential to significantly improve the early detection, monitoring and personalised treatment of cognitive decline in PD. Future studies

may benefit from efforts to devise a more uniform EEG set-up and standardised pipelines for better comparability.

Multibrain decoding reveals complementary neural information during task division

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Successful social interaction often requires individuals to work toward shared goals by dividing tasks. While previous research has investigated alignment between brains during joint attention and action, successful real-world cooperation frequently depends on taking complementary roles and integrating distinct yet interdependent representations. In this study, we investigated whether strategic task division gives rise to a multibrain advantage, wherein the combined neural signals of two individuals carry more information than that of either brain alone. We recorded electroencephalography (EEG) data in 26 pairs as they jointly performed a speeded visual matching task by using shared controls to select a briefly shown target from an array of 25 response options. Targets were defined by the spatial frequency of overlaid blue (-45°) and orange (45°) lines, which varied independently. We imposed colour-specific movement constraints for each participant to encourage task division. Multivariate pattern analysis revealed that individual brains preferentially encoded the spatial frequency linked to the prioritised colour, and that this effect of task division correlated with behavioural performance and increased over the course of the experiment. In addition, we found a late multibrain advantage reflecting enhanced target information decoding at the level of the pair compared to individual brains. This multibrain advantage correlated with the effect of task division on neural decoding and task accuracy, suggesting that strategic task division enables superior encoding of information at the team level, beyond the capacity of individuals. Our findings underscore the role that diverging neural representations play in enhancing cooperative performance by distributing cognitive demands.

Software and hardware: Cognitive reserve and brain structure underlie cognitive heterogeneity in Parkinson's Disease

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Individual differences in lifetime experiences may moderate the association between brain characteristics and task performance, although, the interplay between these factors, brain measures, and Parkinson's disease (PD) outcomes is unclear. Using multimodal magnetic resonance imaging we explored whether lifetime experiences, as a cognitive reserve (CR) proxy, or brain characteristics more strongly predict cognition, learning, and motor function in people with PD. Sixty-one subjects completed lifetime experiences, cognitive, reinforcement learning, and motor function assessments ON and OFF dopamine medication. Structural, diffusion, and resting-state functional imaging measures were investigated. Associations between lifetime experiences, brain measures and outcomes were explored using multiple linear regression. Controlling for demographics, structural and microstructural brain characteristics were associated with CR proxy score. Only the model predicting cognitive performance was significant in both ON and OFF states, with CR proxy score explaining a significant portion of variance beyond brain measures. Structural brain characteristics were associated with cognitive function when OFF medication, but not ON, whereas resting-

state functional brain activity explained a significant portion of cognitive function variance ON medication, but not OFF. CR proxy score was associated with bradykinesia severity ON and OFF medication, but the overall models were non-significant, and no predictors were significant for learning ability, resting tremor, or postural instability. These findings indicate that accumulating enriching lifetime experiences may influence structural brain characteristics in individuals with PD. Moreover, such experiences independently contribute to differences in cognitive performance beyond brain measures, but do not appear to significantly affect reinforcement learning or motor symptoms in PD.

Sheaf networks for the cognitive neuroscience of information binding

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A central problem in cognitive neuroscience is to explain why/how the systematic symbol-like ability to bind information (e.g., colour and shape, so as to distinguish red square and green triangle from red triangle or green square) arises from nonsymbolic, neural-like processes without simply assuming a neural symbol system. A solution to this problem is presented by adapting recent advances in applied algebraic topology/geometry to bridge this explanatory gap. In physics, solutions to the Laplacian equation correspond to minimizing the Dirichlet energy functional for the given boundary conditions (cf. a film of soap in a loop of wire as the boundary, or heat diffusion on a metal plate). A generalized form of this equation, called the sheaf Laplacian, models information flow as local data (vector fields) attached to a topological or geometric space that acts as a neural- like network complex. We suppose that the boundary conditions for this situation to be constituent information, such as colour and shape. Accordingly, an iterative solution to the sheaf Laplacian, i.e. stepwise minimization of the Dirichlet energy functional, called sheaf diffusion, corresponds to the time evolution of information binding, thus bridging the explanatory gap between symbol-like cognitive processes and nonsymbolic, diffusion-like neural activity. This theoretical approach is expected to have applications in cognitive neuroscience where sheaves (i.e. functors on topological spaces) are used to model compositionality [see, e.g., Phillips, (2024). A category theory perspective on the Language of Thought. Frontiers in Psychology, 15, 1361580. doi:10.3389/fpsyg.2024.1361580] Funding: Japanese Society for the Promotion of Science Grant-in-aid (JP23K11797)

The application of neurofeedback to stress and trauma: A systematic review and meta-analysis

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Chronic and traumatic stress can lead to physical ill-health and psychopathology. Non- invasive neurofeedback has emerged as a potential tool to reduce stress and traumatic stress symptoms through self-regulation of neural activity. This review aimed to systematically evaluate and meta-analyse evidence from randomised controlled trials on the efficacy of neurofeedback in reducing stress and traumatic stress symptoms, providing an updated synthesis of the existing literature. Study quality was assessed using the Joanna Briggs Institute-RCT Appraisal Tool and Cred-NF Checklist. Inverse-variance random effects models found a small-to-moderate effect of neurofeedback outperforming controls in the 15 included studies on stress (Hedge's $g = 0.40$, $p < .001$, I-squared = 17.93) and a moderate effect favouring neurofeedback in the 10 included studies on traumatic stress (Hedge's $g = 0.70$, $p < .001$, I-squared = 57.44). Protocols aimed at shifting neural activity towards the alpha and sensorimotor rhythm ranges, and away from the beta range consistently reduced stress. Traumatic stress symptoms were alleviated by protocols modulating amygdala and alpha activity. Symptom improvements are discussed in relation to existing neurophysiological theories, and directions for future research are outlined.

Temporal Mapping of Neural Processing Stages via Model- optimised Stimulus Selection

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Investigating the underlying stages of human visual processing benefits from the use of carefully selected stimuli. These stimuli should evoke distinct activation patterns across cortical regions and unfold over temporally defined processing stages. We present a method for constructing such an optimised stimulus set by diversifying representational geometry across individual layers of an artificial neural network. Specifically, we extract activation patterns from a pretrained network, compute the representational geometry at each layer, and apply a greedy, optimal-stopping procedure to assemble a subset of stimuli that minimizes redundancy between layers. In an EEG experiment, presenting the resulting 200 image subset elicited neural responses that are temporally well-resolved, as evidenced by sharp peaks in pairwise decoding accuracy and strong correspondences between neural geometry and geometry of the artificial network. Crucially, these correspondences followed a systematic temporal alignment: early network layers mapped onto early neural responses around 100ms, while deeper layers peak distinctly later in time around 300ms, mirroring the hierarchical cascade of human vision. In this way, structured and strategic stimulus choice can reveal temporal dynamics that may remain obscured with conventional image sets. The result is a realignment of neural data into a hierarchical sequence that closely tracks artificial network processing, offering evidence that computational hierarchies recapitulate the temporal cascade of human visual processing.

Can the quantum approach apply to conscious perceptual judgement?

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Quantum Cognition uses the mathematical framework of quantum theory (without the physics) to model behaviours and has gained recognition over the decades. Recently, a similar approach was proposed for the study of consciousness. Quantum Cognition, unlike its classical counterpart, naturally considers the effect of "measurement" to predict what difference questioning participants can make on behavioural reports. However, the current evidence mostly revolves around amodal judgements. For example, Yearsley and Emmanuel (2016) has shown that frequent expression of opinion in a fictional murder case slowed changes in participant's opinion when counter-evidence accumulated (also known as Quantum-like Zeno Effects or QZ).

To examine whether QZ exists in conscious perception, we conducted three experiments, where we asked online participants to detect changes from a stimulus presented at trial start. They were asked to report the presence/absence of change in a series of accumulating evidence of change (or not). In Exp 1, we used moving colour-gratings, while in Exp 2 and 3, we used natural-scene images. We gradually changed the color (Exp 1, N=92) , the contrasts (Exp 2, N=81) as well as faded objects (Exp 3, N=83). By varying report frequencies, we constructed a quantum and a Bayesian model, fitting only three parameters, and quantified the prediction accuracy for the data not used for fitting. Unlike the abstract cognitive case, our results showed that the quantum model didn't fit particularly better than the classical model and model fits were generally poor. We will discuss the implications in the conference.

Effect of retroactive interference on micro-consolidation of a visuomotor sequence

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Micro-consolidation is a process underpinning initial

improvements in motor skill. The behavioural hallmark of micro-consolidation is offline gains during short rest periods interspersed between practice epochs. Micro-offline gains have been shown to be sensitive to retroactive interference when a second visuomotor sequence is also practiced. However, it is unknown whether the effect of interference on micro-consolidation occurs within a spatial or motor reference frame. This study investigated the effect of reference frame on retroactive interference during a serial reaction time task (SRTT). Ninety-eight (18-57 years,

58.2% female) participants performed an SRTT, wherein a subsequent interfering sequence was introduced, consisting of coordinates that were either in a different spatial (n=25) or motor (n=29) reference frame, or were congruent (n=21) or incongruent across both (n=23). Based on an influential model of how reference frames shift over the course of early skill learning, it was hypothesised that the effect of interference on micro-offline gains would be greatest when the interfering sequence was presented in a different spatial reference frame, compared to when it was spatially congruent. In contrast to the hypothesis, our preliminary results indicate no significant differences in early learning between groups. Overall, our findings suggest a dual role for both spatial and motor reference frames in the early offline consolidation of motor skills.

Lisdexamfetamine Dimesylate (LDX) Pharmacotherapy for Binge Eating Disorder is Associated with Behavioural and Neurocognitive Changes during Pavlovian-to-Instrumental Transfer

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Lisdexamfetamine Dimesylate (LDX) is the only medication currently approved to treat BED. While safety and efficacy are well established, mechanisms of action remain uncertain. One hypothesis is that LDX normalises functioning in reward- and control-related domains critical to BED symptomology.

This hypothesis was examined in open-label registered clinical trial (ACTRN12618000623291)[1], incorporating 46 individuals with BED and 20 age and sex matched controls. This study analysed behavioural and neuroimaging data collected during the Vending Machine Task, which measures Pavlovian-to-Instrumental Transfer (PIT). PIT effects quantify interacting cue-driven reward learning and inhibitory control processes.

Behaviourally, we found significant differences in Specific PIT between BED and control groups at baseline, and normalisation within the BED group following treatment, driven by a reduction in non-optimal response rates. Further, treatment-related changes in Specific PIT significantly predicted reduction in binge eating frequency (days/week), the primary clinical outcome of this trial.

During Specific PIT, whole-brain fMRI showed greater activation in participants with BED compared to controls in key occipital cortex areas and cerebellum, suggesting heightened visual and motivational processing in response to reward cues. Conversely, regions including the dorsolateral prefrontal cortex, and orbitofrontal cortex were more strongly engaged in controls, indicating more regulated responses to rewards. Further analyses are continuing to confirm these preliminary results.

These findings indicate a unique phenotype in individuals with BED characterised by heightened neural and behavioural responsivity to reward-predicting cues, which was ameliorated following LDX treatment by improved goal-directed attention and inhibitory control. Thus, these may be key mechanisms by which LDX reduces binge eating behaviour.

Interaction between retinotopic and numerotopic field maps in parietal cortex with 7T fMRI

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Human intraparietal cortices are known to encode numerosity of single sets through topographically organised (i.e., numerotopic) maps. Here we aimed to explore how the numerosity of multiple sets are encoded simultaneously, hypothesising that concurrent stimulus arrays might be represented separately and kept neurally distinct using visuospatial (i.e., retinotopic) coding. We tested this hypothesis using ultra-high-field (7T) fMRI together with a delay-cued enumeration task. Eight adults (4 female) each completed 16 runs (32 trials per run) where a set of black/white intermixed dots (n=5-25) was shown on the left and right sides of the screen (600ms) followed by a blank screen (4000ms). A leftward/rightward-pointed arrow cued participants to report the numerosity of either set. Participants were accurate overall but left stimuli were underestimated (-0.52, SD=1.0) while right stimuli were overestimated (0.48, SD=0.73), $t(7)=-3.00$, $p=0.013$. Population receptive field (pRF) models were estimated from task BOLD time-series with a focus on parietal maps (NPC). Fitting two 1D pRFs simultaneously, preferred numerosities correlated across voxels (left NPC: $t(7)=7.86$, $p<0.001$; right NPC: $t(7)=3.89$, $p=0.006$). Using voxelwise Bayesian inversion of these pRF models, we decoded the maximum likelihood representation of the left and right set at the same time above chance. Decoding accuracy in right NPC predicted behavioural accuracy of left-cued stimuli ($r(8)=-0.84$, $p=0.004$), and vice versa ($r(8)=-0.61$, $p=0.055$). Our findings show retinotopic and numerotopic coding in human association cortices support flexible representation of multiple distinct numerosities. They also suggest numerical choice options in decision-making tasks can be presented concurrently, allowing for more efficient experimental designs.

MRI-based prediction of cognitive functioning: Unpacking between-individual differences and longitudinal change

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Machine learning models trained on brain MRI can predict cognitive functioning, especially when combining multiple imaging modalities. However, it is not clear whether these markers primarily capture differences between people or can also detect changes within individuals over time. This distinction matters for practical applications: MRI-based markers that reflect between-person differences are more suited for diagnosis or risk assessment, while markers sensitive to within-individual changes might allow monitoring the progression of cognitive changes or response to treatment. To address this, we used longitudinal data from the Dallas Lifespan Brain Study (n = 451, aged 21–90, up to 3 sessions over 5 years). Thirty-seven neuroimaging phenotypes, including structural MRI, diffusion imaging, functional connectivity, task-based functional MRI, and arterial spin labelling, were used to train out-of-sample predictive models of cognitive functioning. Diffusion and structural MRI models showed the strongest predictive performance (correlation ≈ 0.57–0.64). Stacking across modalities improved accuracy, with multimodal stacking reaching the best results (correlation = 0.73). Linear mixed-effects models showed that MRI explained up to 54% of the total variance in cognitive functioning, primarily due to between-person effects. The multimodal stacking model captured 59.9% of between-person and 7.7% of within-person variance. Commonality analysis showed 77.3% of variance explained by MRI-based markers overlapped with age, but MRI-based markers still added unique information beyond age alone. Findings suggest that while MRI-based markers robustly track individual differences in cognitive functioning, their capacity to detect longitudinal cognitive change is modest.

Resting-state alpha and theta EEG power predict motor imagery ability in children with and without DCD

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Motor imagery (MI) difficulties are frequently observed in children with developmental coordination disorder (DCD), yet the neural mechanisms underlying these impairments remain poorly understood. This study addressed this gap by examining the contribution of resting-state oscillatory activity to MI performance in children with and without DCD. Participants (14 with DCD, 30 controls), aged 5–14, completed a validated hand rotation task (HRT) assessing MI across medial, lateral, and total rotation conditions. Resting-state EEG was recorded during eyes-open and eyes-closed conditions, with spectral power extracted using EEGLAB in MATLAB. A one-way ANCOVA showed significantly lower HRT efficiency for biomechanically complex lateral rotations in the DCD group compared to controls. In the eyes-open condition, partial Spearman analyses revealed significant (and trend level) negative correlations between theta power and total mean inverse efficiency score (IES) (FDR corrected) at fronto-parietal electrodes. No significant associations were found between alpha and HRT performance. This study highlights impaired MI performance in children with DCD, especially for biomechanically complex movements. Notably, resting- state theta power in fronto-parietal regions was associated with MI efficiency. Given the role of theta activity in global inhibitory processing, our findings suggest that decreased MI efficiency, such as those observed in DCD, may be associated with atypical inhibitory mechanisms in fronto-parietal regions.

Neural Tuning to Visual Motion Stimuli Depends on the Precision of Learned Priors

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Perceptual choices are often subject to uncertainty. For instance, deciding to cross the road can be complicated by poor weather and busy traffic. To navigate decision uncertainty, adaptive choices factor prior knowledge about sensory input into the decision-making process, such as the likely direction of vehicle movement at an intersection. Bayesian- inspired choice theories posit that prior knowledge enhances representations of sensory features that are more likely, which in turn biases responses in favour of more probable stimuli. Under this view, an optimal decision should strike a balance between prior knowledge and incoming sensory evidence by weighting each component by its respective reliability (i.e., precision). Such views have been shown to account for behavioural effects in perceptual decision-making tasks, but the neural mechanisms that support precision- weighted choices remain unclear. Here, we independently manipulated the precision of prior knowledge and sensory evidence in a dot-motion estimation task while recording brain activity with electroencephalography (EEG; N = 40). Participants reported the direction of noisy motion targets whose direction was sampled from a prior distribution defined by a mean and precision that changed every block. Using inverted encoding models, we characterized feature-tuned neural responses as they evolved throughout the decision process. Neural tuning to motion directions, and behavioural responses, were both affected by the precision of priors and sensory inputs. These findings suggest that biases in perceptual decisions predicted by Bayes-inspired choice theories might be driven by feature-specific neural responses.

Impact of puberty age gap on resting-state functional connectivity

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Pubertal timing is a key individual difference shaping adolescent brain development and mental health, yet its impact on large-scale cortical network organization is poorly understood. This

study examined whether pubertal timing, operationalised as puberty age gap (PAG), the difference between predicted puberty age and chronological age, predicts resting-state functional connectivity (rs-FC) across adolescence. Data were drawn from the Adolescent Brain Cognitive Development (ABCD) Study (N≈3,500; baseline to 4-year follow- up). PAG was estimated from physical and/or hormonal indicators using sex-stratified generalized additive models, and rs-FC was calculated across 12 cortical networks. Cross- sectional and longitudinal associations were tested separately for males and females with correction for multiple comparisons. Cross-sectionally, earlier timing (higher PAG) was associated with weaker rs-FC in sensorimotor and attention/salience networks in females, and in sensorimotor and executive networks in males, with broader effects observed in females. Longitudinal analyses revealed sex-specific effects, with females showing widespread changes in executive and sensorimotor networks, while males exhibited more restricted sensorimotor effects. No differences emerged between adrenal and gonadal phases or between physical- and hormone-based PAG measures, suggesting consistent associations across pubertal phases and indicators. These findings highlight puberty age gap as a meaningful predictor of cortical network organization, with stronger and broader effects in females, particularly in sensorimotor, executive, and salience systems. The results underscore sex-specific pathways through which pubertal development may shape brain function and mental health during adolescence.

Ultra-fast 7T fMRI gives new insight into hemispheric communication in visual perception

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The left and right hemispheres of the human brain initially process visual information from the contralateral (opposite) hemifield, yet we perceive the world as a unified whole. This seamless integration is underpinned by communication between the two hemispheres and has wide-reaching implications for fundamental principles of neural functioning. Here, we employed high-field 7-Tesla functional magnetic resonance imaging (fMRI) to investigate hemispheric communication for visual perception. Specifically, we aimed to determine whether information transfer occurs between distinct homotopic regions of visual cortex or involves broader network-level interactions across the visual hierarchy. Participants (N=20) viewed 56 naturalistic stimuli (32 objects, 12 faces, 12 images with words) presented foveally or lateralised to the left or right visual fields while performing an orthogonal fixation task. Images were presented in an ultra-fast event-related design, allowing more than 4700 trials in a one-hour session. Using multivariate pattern analysis, we found that neural information had higher fidelity in the contralateral than the ipsilateral visual cortex, with distinct representational geometries in each hemisphere. Object representations were systematically transformed throughout the visual hierarchy, with increasing abstraction in higher-level regions of both hemispheres. Finally, fusion analyses between fMRI and electroencephalography activity patterns revealed spatial-temporal correspondence of object representations are distinct in the contralateral and ipsilateral hemispheres. Taken together, our findings shed light on how visual information transforms as it moves between brain regions, and provide insights into how perceptual and conceptual information is represented in each hemisphere over time.

Independent component subtraction distorts the neural signal in electroencephalography data, so targeted artifact reduction is better

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EEG data are usually contaminated with non-neural artifacts, including voltage shifts generated by eye movements, high frequency artifacts from muscle activity, and other artifacts. The confounding influence of artifacts is often addressed by decomposing data into components and subtracting components that are deemed to reflect artifacts. In recent decades, this has typically been achieved using independent component analysis (ICA). We tested whether ICA distorts underlying neural activity, using event-related potentials (ERPs), measures of functional connectivity between scalp electrodes, estimates of the location of source dipoles, and source localised connectivity. To determine potential distortion, we compared outcome measures between data cleaned of eye movements and raw data, after exclusion of all periods that were affected by eye movements. Due to imperfect component separation, our results showed that ICA removes neural signals as well as artifacts. This led to artificially inflated effect sizes for ERPs and connectivity measures, biased source localisation estimates, and less precise estimates of source localised connectivity. To address this issue, we developed a method that targets cleaning to the artifact periods of eye movements and artifact frequencies of muscle components. Our results showed that targeted artifact reduction effectively cleaned artifacts while also reducing distortion of outcome measures. Targeted artifact reduction also increased measurement precision compared to ICA (by a factor of 10 for source localised connectivity). Our results suggest EEG processing is better when targeted cleaning is applied, which reduces distortion and increase measurement precision. These improvements enhance the reliability, validity, and statistical power of EEG data analysis.

Assessing the utility of neuroimaging and behavioural biomarkers of post-stroke cognitive recovery outcomes

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Lesion anatomy may help predict cognitive outcomes after stroke, but it is unclear whether lesion anatomy adds information relative to other established predictors. Stroke survivors (n = 408) completed the Oxford Cognitive Screen (OCS) during acute hospitalisation and at chronic (6-month) follow-up. Neural correlates (ROIs and disconnection profiles) associated with chronic OCS scores were identified using lesion mapping approaches. The predictive value of these correlates (relative to acute behaviour rand pre-morbid brain health) was evaluated using regression, receiver operating curve (ROC), and support vector regression (SVR) analyses.

Significant lesion and disconnection correlates of chronic cognitive impairment were identified for 9/10 OCS subtests. The extent of damage to these correlates was significantly associated with chronic cognitive scores, but these measures' diagnostic utility was classed as either poor or of no value in ROC analyses (AUC mean = 0.59, range= 0.46–0.66). Acute cognition was the single best predictor of chronic cognition (AUC mean = 0.66, range = 0.41–0.81). SVR models predicting cognitive outcomes based on acute cognition significantly outperformed models trained on lesion anatomy within 8/10 subtests and did not perform differently in the remaining 2 subtests. SVR models trained using both anatomy and acute behaviour did not yield improved outcome predictions compared to models trained on behaviour alone. Overall, these results highlight that statistically significant lesion to cognitive outcome relationships alone are not sufficient to infer potential prognostic utility and provide conceptual guidance for future studies aiming to develop accurate and generalisable prognostic models for post-stroke cognitive outcomes.

A mental math stress task increases motor cortical and spinal motoneuronal excitability

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Stress causes many changes to the human nervous system. However, few studies have examined how stress affects the function of motor circuits in the human brain and spinal cord. In the current study, we examined the effects of a mental stress task on human corticospinal and motoneuronal excitability. Fourteen healthy participants were recruited into a single-session, within-subject design. A serial subtraction task was employed to induce stress, which required participants to count backwards by 13 from a large four-digit number under time- and experimenter-induced pressure. Before, during and after the serial subtraction task, transcranial magnetic stimulation elicited motor evoked potentials (MEPs), and supramaximal peripheral nerve stimulation evoked F-waves, in the electromyography signal recorded from a small hand muscle. Subjective stress ratings and heart rate measures were also obtained. Our preliminary analyses show that, compared to baseline and post-task control measures (which involved counting by ones), the serial subtraction task increased stress ratings and heart rate. The same task also increased the size of MEPs and F-waves compared with baseline and post-task. Overall, results suggest that the serial subtraction task augmented subjective perceptions and autonomic markers of stress. When these indicators of stress were increased, so too was motor cortical and spinal motoneuron excitability, suggesting that stress biases the output of motor pathways to favour muscle activation. We postulate that under high arousal/stressful situations, an enhanced output of the corticospinal system and motoneurons enables the more efficient activation of muscle, which perhaps offers significant advantages from an evolutionary context.

The influence of stimulus exposure duration on deepfake detection accuracy

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The emergence of AI-generated deepfakes raises critical questions about authenticity, perception, and the evolving role of media in shaping truth. Prior research on deepfake detection has consistently shown that people perform at or near chance level when judging the veracity of faces. Most studies, however, have not controlled for stimulus viewing time, leaving it unclear whether deepfake detection accuracy is influenced by stimulus exposure duration. To address this, we conducted an online experiment to examine observers' ability to discriminate real from AI-generated faces presented under brief exposure conditions. Participants saw a singleton face for one of five short exposure durations (between 33-100ms), immediately followed by a mask. They then classified each face as either real or fake, followed by a confidence rating. Stimuli were 50 real and 100 AI-generated deepfakes (subdivided into realistic and unrealistic fakes) appearing in a randomised order across the five exposure duration conditions for a total of 750 trials. Preliminary analyses show that deepfake detection accuracy and sensitivity varies as a function of stimulus exposure time, revealing potential interactions between temporal constraints and the realism of deepfakes. These findings highlight the potential role of exposure duration in human deepfake detection as well as the challenges inherent in identifying AI-generated media under rapid exposure.

Testing Critical Assumptions of Attention Restoration Theory: Subjective Scope in Nature Images Predicts Cognitive Performance

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Cognitive fatigue from demanding tasks can impair attention and reduce overall well-being. A growing literature suggests that exposure to natural environments may help restore depleted attentional resources, potentially offering a cheap and accessible mitigation to attentional fatigue. However, critical assumptions of this Attention Restoration Theory (ART) remain untested: including whether image exposure induces true restoration effects (i.e. a change from baseline), and whether restoration effects scale with either the objective or subjective features of viewed natural images.

The present study investigated these critical assumptions in an online experiment. On each trial, participants (N = 49) first engaged in an easy or hard visual search task to induce attentional fatigue. The Digit Span Backward (DSB) task was then completed both before and after natural image exposure as a measure of cognitive performance that is baseline controlled. Critically, natural images were parametrically varied to have objectively low, medium, or high vegetation levels, and subjective ratings of image fascination, being away, coherence, and scope were quantified using the perceived restorativeness scale (PRS-11).

Only the subjective factor of scope – that explains how spacious an environment feels to allow further exploration – significantly predicted DSB performance. Importantly, neither the objective vegetation levels, nor degree of attentional fatigue predicted changes in cognitive performance. These findings raise questions about which environmental features best support attention restoration and highlight the importance of individually tailored images and environments for attentional restoration. Future research is needed to further clarify both the theoretical framework and methodological approaches used to test ART.

Predictive motion extrapolation requires visual attention

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Transmission and processing of incoming sensory signals in the nervous system takes time, such that the brain only ever has access to outdated afferent sensory information. These neural delays cause challenges when interacting with fast-moving objects in real-time, such as when playing ball-sports or navigating through traffic.

The fact that we are nevertheless able to play tennis and safely cross busy streets demonstrates that the brain somehow solves these computational challenges. In the visual domain, several lines of evidence are currently converging to indicate that predictive neural mechanisms, implemented at multiple stages in the visual processing hierarchy, together use recent motion trajectories to "predict the present". In this way, sensory regions might represent a dynamic environment in real-time despite neural delays.

As visual scenes become more complicated, extrapolating the dynamic trajectories of multiple moving objects rapidly becomes computationally intractable. In other domains of vision science, similar computational overload is putatively solved by selective attention, which selects a subset of sensory input for further processing, whilst discarding others.

Here, we use a time-resolved multivariate EEG-decoding paradigm to investigate whether attention similarly selects sensory input for prediction. By superimposing two apparent motion streams, and instructing participants to attend one whilst ignoring the other, we compare the real-time neural position representations of attended and unattended moving objects. We show that anticipatory neural pre-activation is only observed for the attended object. This provides the first direct neural evidence that, at least in the case of visual motion extrapolation, prediction requires attention.

The moment-to-moment variability of cerebral glucose use shapes the network efficiency and information processing capacity of the brain

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Dynamic shifts in brain network connectivity underpin cognitive function and are driven by fluctuations in haemodynamic and electrophysiological signals. How these shifts in network connectivity are shaped by the brain's dynamic use of glucose - or 'glucodynamics ' - is unclear. Here we use functional Positron Emission Tomography (fPET) to generate a timeseries of cerebral glucose use in 77 healthy adults (35 younger: 20–42 years; 42 older: 66–86 years). We quantify variability in glucose use and its relationship with metabolic network efficiency and cognitive performance. A 'static' or cumulative measure of glucose metabolism across the entire scan did not predict cognition. Higher variability in glucose utilisation predicted better cognitive performance directly and indirectly via enhanced network efficiency. Older adults exhibited significantly reduced variability in glucose use. These findings position glucodynamics as a fundamental feature of brain network organisation, enabling flexible, efficient information transfer via synchronized metabolic activity in brain networks. Age-related reductions in glucose variability constrain the brain's ability to transition between network states and contribute to declines in cognitive performance in ageing. Studying glucodynamics offers novel insights into metabolic contributions to brain function in health and disease.

EEG Markers Vary With Depression Severity

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Depression is a psychiatric disorder that greatly compromises daily functioning, societal productivity, and quality of life. It is associated with aberrant neural activity (e.g., altered balance of excitation-inhibition) across networks involved in emotional processing, such as between prefrontal and limbic regions. High frequency oscillations measured with electroencephalography (i.e., beta and gamma rhythms) differ between healthy individuals and those with depression, and predict treatment outcomes following pharmacological intervention. However, to date research has focussed on binary comparisons between individuals with a clinical depression diagnosis relative to healthy control populations, providing limited insight into how these measures may shift as a function of illness severity. To establish the utility of EEG measures as potential biomarkers for depression, an improved understanding across the spectrum of symptom profiles is required. Here, we aimed to bridge this gap by analysing two open source datasets (n = 173 and n = 113), investigating changes in high frequency oscillations and the 1/f slope in resting-state EEG across a spectrum of mild to severe depression symptom presentations. In line with expectations, we demonstrate graded alterations to gamma and beta power and the 1/f slope across a spectrum of depression severity. Our findings add crucial nuance to our understanding of the neurophysiological signature of depression symptoms, and highlight the utility of EEG markers to enrich precision psychiatry approaches to better understand, assess, and treat depression.

Developmental trajectories of brain dysfunction during error processing among adolescents at risk for schizophrenia

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Schizophrenia is characterised by significant reductions in the amplitude of the error related negativity (ERN/Ne) and later positivity (Pe) event-related potentials (ERPs) elicited by erroneous responses. Characterising the developmental evolution of these error- processing abnormalities among children at high-risk of schizophrenia may help inform opportunities for preventive interventions to mitigate the emergence of these cognitive dysfunctions. This study used longitudinal ERP data, gathered in three assessments completed biennially between the ages of 9 and 17 years, to map the developmental trajectory of ERN/Ne and Pe abnormalities in at-risk children. Children were sampled from the community and categorised into three groups according to their risk profile: i) children who presented with a triad of well-replicated antecedents of schizophrenia (ASz; n=29); ii) children with a

family history of schizophrenia/schizoaffective disorder (FHx; n=29); and iii) typically developing (low-risk) children (TD; n=31). Linear mixed models compared the ERN/Ne and Pe amplitudes and latencies of each high-risk group (ASz, FHx) relative to TD peers. Preliminary results indicated significant reductions in ERN/Ne amplitude at the initial assessment (mean age 11 years) in both ASz and FHx children, each compared to TD children, with these deficits persisting through age 17 years. ERN/Ne latency and Pe amplitude and latency were unaffected. The early emergence of ERN/Ne amplitude reductions suggest that interventions targeting early error-processing abnormalities may be most effective if administered during childhood among at-risk children, well prior to the typical onset of illness in young adulthood.

The effects of rewards and punishments on action execution and inhibition

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Monetary rewards and punishments influence volitional motor actions by decreasing reaction times via increased motivation. Yet, their effects on action cancellation remain debated. This study investigated whether monetary incentives of varying magnitudes were able to differentially improve motor performance and action cancellation.

Participants (n=24) were assessed using an incentivised motor control task, wherein random four-element sequences were performed as quickly as possible, with the requirement to unexpectedly cancel initiated actions on 1/3 of trials. The performance contingent monetary incentives consisted of (1) large reward, (2) small reward, (3) large punishment, (4) small punishment and, (5) neutral where stimuli were presented in the absence of reward or punishment.

Reward and Punishment enhanced action execution, via speeding both reaction and movement times, whilst maintaining sequence accuracy. Furthermore, reward demonstrated superior action execution facilitation, as compared to punishment. A clear effect of magnitude was observed, whereby large reward produced the greatest improvement in action execution. Interestingly, response inhibition was selectively facilitated by large punishment and small reward only, as indicated through decreased stop signal reaction times (SSRTs).

The effects of reward and punishment in this dataset corroborate the beneficial aspects of monetary incentivisation. Action execution improvements indicate the motor system integrates incentive magnitude to enhance task performance. Importantly, the contrasting results of action execution and inhibition demonstrate dissociable motivational effects on these distinct motor control processes, with action execution showing graded sensitivity to incentive magnitude whereas action cancellation exhibits facilitation only in specific incentive conditions.

Exposure to nature scenes improves the efficiency of inhibitory control in a conflict monitoring task

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Exposure to natural environments commonly produces greater cognitive performance improvements than exposures to urban or control settings. These benefits are commonly explained by Attention Restoration Theory, which proposes that natural settings replenish the limited resource of 'directed attention'. Despite widespread use of conflict monitoring/resolution tasks to assess behavioural performance (e.g., Stroop and Flanker paradigms), modulation of the conflict-related N2 ERP component has received little investigation.

Participants (n=43) were randomly allocated to experience a 13-minute video (with audio) presentation of either natural or urban scenes. EEG was continuously recorded throughout a session involving a cognitive fatigue induction phase (Stroop task) followed by pre- and post-exposure completion of a Flanker Go/No-Go Task. Bayesian hierarchical modelling was used to assess differences in cognitive performance via

response times, error rates, and frontal N2 amplitude, along with exploratory analysis of frontal Theta/Beta Ratio (TBR).

Both groups became faster and more accurate post-exposure, however, improvements were reliably larger in the nature condition. Additionally, N2 amplitude decreased after nature exposure only, compared with an increase after urban exposure. TBR was increased only after urban exposure.

These findings replicate previous observations of N2 amplitude reduction as an electrophysiological effect of nature exposure. The combination of behavioural improvement and N2 amplitude reduction suggests improved efficiency of inhibitory control processing after nature exposure, relative to urban exposure. TBR may also be linked with conflict monitoring/resolution, although the correlations between electrophysiological changes and behavioural performance improvement were not always conclusive.

Validation of a Brief Cognitive Task for Assessing Punishment Insensitivity

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Punishment insensitivity plays a crucial role in the development and maintenance of substance addiction. Previous studies employing a human conditioned punishment task have identified key cognitive underpinnings of punishment insensitivity. However, the original task's extended duration and complex instructions may limit its feasibility for use in clinical or time-constrained research settings.

The present study sought to develop and validate a shortened version of the task and examine its utility in identifying punishment insensitivity among healthy individuals. University students completed the condensed task online, and their performance and task- derived behavioural phenotypes were compared with those from the original extended version. The prevalence of three key behavioural phenotypes was comparable across the short and long versions of the task. Consistent with prior findings, individuals exposed to infrequent punishment were more likely to exhibit punishment-insensitive behaviour, which might be due to failures in forming accurate causal beliefs and using this knowledge to update behaviour accordingly. In contrast, participants receiving stronger punishment contingencies were more likely to infer the underlying contingencies and modify their behaviour to obtain rewards and avoid punishments. These results support the validity of the shortened task and its potential as a practical tool for investigating punishment insensitivity.

Investigating the Globality of GABAergic Inhibition changes in the motor system

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When stopping a planned action, inhibitory control is thought to be engaged in ways that are either highly selective to the specific effector or global across the motor system, with some research suggesting that global inhibition is faster and requires less planning. Using transcranial magnetic stimulation (TMS), prior work has linked successful stopping of manual actions with rapid increases in short-interval intracortical inhibition (SICI) in primary motor cortex, a marker of GABA-A activity. However, the extent to which these GABAergic changes reflect global or selective inhibition is not fully known. In this study, we measured SICI by applying paired-pulse TMS to left motor cortex (recording motor-evoked potentials in the right hand) while participants completed a stop signal task. We varied the effector that participants used to respond to go cues in the task (e.g., saccade eye movement), thereby creating conditions in which the right hand was engaged in the task or completely at rest. We tested the hypothesis that SICI increases on stop trials irrespective of effector engagement, consistent with a global inhibitory mechanism; modulation restricted to the engaged condition would instead support selective control. The results provide key insights into how global and selective inhibition contribute to the efficient inhibitory control.

Does culture shape our perception? A comparative study on Japanese mora perception between Japanese and English speakers

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Do individuals from different cultures perceive the world in the same way? While it is commonly assumed that culture influences the way we think, the question remains whether it also shapes the qualitative aspects of our subjective experiences, often referred to as qualia. Although some evidence suggests that certain subjective experiences, such as color perception, are universally shared across cultures, it is unclear whether individuals from a given culture perceive its cultural-specific stimuli, such as the phonetic sounds of their language, differently than those who are unaccustomed to it. To investigate this, we employed a relational approach to characterize the structure of Japanese phonetic sound qualia in speakers whose familiarity with Japanese vary (from native speakers to complete novice). In each trial, we presented a random pair of Japanese moras (the phonetic unit of Japanese words, all 101 of them are composed of a vowel and, optionally, a preceding consonant) and asked participants to rate their subjective similarity. While data collection is ongoing, preliminary results indicate that the phonetic qualia structures of Japanese and English speakers are largely similar, although Japanese speakers perceive moras with different consonants as more dissimilar than English speakers do. Overall, our study explores the similarities and differences in the perception of phonetic sounds across cultures, which sheds light on how cultural experiences may influence the way we perceive the world.

Perceptual misjudgement and decision-making in traffic interactions with electric mobility devices (EMDs)

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Electric mobility devices (EMDs), particularly e-scooters and e-bikes, are becoming increasingly prevalent on Australian roads. However, their small size, rapid acceleration, and quiet operation may contribute to perceptual misjudgements by other road users. This study investigated gap acceptance when interacting with EMDs compared to larger vehicles, with a focus on speed underestimation and vehicle novelty. Forty licensed drivers completed a within-subjects, video-based psychophysical experiment simulating right-turn decisions at intersections. Participants viewed footage of seven vehicle types (bicycle, e- scooter, e-bike, motorbike, small car, SUV, and truck) approaching at a range of speeds and indicated the latest moment at which they would safely initiate a crossing. Stimuli were recorded under controlled conditions and presented via a driving simulation setup, with response times logged to quantify accepted temporal gaps. Preliminary analyses support the hypothesis that participants accepted significantly smaller gaps for e-scooters compared to larger vehicles, suggesting systematic underestimation of their speed. These findings highlight a potential perceptual hazard contributing to unsafe crossing decisions in mixed- traffic environments. Future research should extend this work to naturalistic driving contexts and diverse road layouts, with applications for intersection design, public education campaigns, and targeted EMD regulations aimed at improving safety in interactions with emerging micro-mobility technologies.

Long-term reliability of parameterized resting state EEG: Evidence from a five-year follow-up

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Recent additions to the cognitive neuroscientist's toolbox have spurred interest in the spectral parameterisation of neural activity. Several aspects of parameterised neural activity, including the aperiodic exponent and individual peak alpha frequency, have emerged as promising biomarkers for ageing, pathology, and cognitive decline. Although these components hold considerable promise for such applications, this potential is tempered by a lack of evidence on their long-term temporal stability. Existing investigations have largely relied on cross-sectional designs or considered stability for up to 90 days. In the current study, we examined five-year reliability, stability, and age-related changes in periodic and aperiodic neural activity using electroencephalography in a sample of 150 healthy adults aged 20-70 years. Resting-state eyes-closed and eyes-open EEG was recorded in two sessions approximately five years apart. We extracted aperiodic exponents, alpha power, and individual alpha peak frequency from four regions of interest. All parameters demonstrated good to excellent test-retest reliability (intraclass correlations = 0.64-0.88). Linear mixed models showed that over five-years individual peak alpha frequency decreased, the aperiodic exponent flattened, and alpha power was unchanged. There were no interactions between time and age. Our findings suggest that parameterised activity is both reliable over long timeframes and reflects age-related processes. Although these metrics likely capture neural ageing, they do not show evidence of accelerated decline in later life in a normally-ageing sample. Spectral parameterisation may provide a reliable means of characterising gradual, normative neurophysiological ageing. Future research should explore the potential utility of identifying deviations that may indicate pathology.

Decoding distraction: An EEG study of value-modulated attentional capture

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The ability to resist distraction and maintain attentional control is essential for successful performance. Past research has demonstrated that distraction can be driven by prior experiences. For example, individuals look towards task-irrelevant stimuli when those stimuli signal high-value reward outcomes, leading to less accurate and slowed responses to goal-relevant targets. While this behavioural effect, known as value-modulated attentional capture (VMAC), has been well documented, limited past research has explored the impacts of learned stimulus values on the neural representations of stimulus-response components necessary for successful action selection. Here, we aim to investigate the neural consequences of VMAC using electroencephalography (EEG). Specifically, we aim to test whether high-value distractor stimuli disrupt the neural representation of task-relevant components (e.g., target location, response selection) and whether this disruption predicts impaired behavioural performance. In this ongoing

study (n = 15), participants respond to the location of a target stimulus according to a pre-cued response rule while ignoring a coloured distractor stimulus. The colour of the distractor stimulus signals the amount of reward available (high vs. low) for a correct response, but is otherwise task irrelevant. Multivariate pattern analysis of EEG data will enable time-resolved decoding of distractor value and task-relevant components, including the response rule, stimulus location, and appropriate stimulus-response mapping. The effect of attentional capture on decoding of task-relevant features will be investigated by comparing decoding accuracy on high- relative to low-value distractor trials. We anticipate that our findings will provide new insights into the neural mechanisms underlying distraction driven by prior experience.

To Approach or Avoid? Perceptual Similarity Judgements Reveal That We Encode Pain Faces As Negative Emotions

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Facial expressions associated with pain are thought to be evolutionarily salient social signals, but it is unclear whether they drive approach or avoidant responses from conspecifics. On the one hand, pain-related expressions may flag potential environmental threats and recruit the neural systems responsible for detecting and avoiding threats. On the other hand, pain-related expressions may communicate vulnerability and recruit the neural systems responsible for approach behaviours and caregiving.

To probe whether pain-related facial expressions are perceived as negative facial expressions that induce avoidant behaviours, or as positive facial expressions that induce approach behaviours, we ran an unbiased triplet odd-one-out experiment using 120 naturalistic faces depicting pain, fear, disgust, neutral, happiness, and victory. During trials, participants (n=166; 49,800 trials in total) saw three faces drawn randomly and selected the odd-one-out. Behavioural dissimilarity was captured in a representational dissimilarity matrix (RDM) and compared to two differing valence models: one grouping pain with the two other negative emotions (i.e., fear and disgust), the other grouping pain with the two other positive emotions (i.e., happiness and victory).

Results show that the negative emotion model (ρ = 0.714) better explained task behaviour than the positive emotion model (ρ = 0.396). Multidimensional scaling confirmed that the pain faces were clustered more closely to the fear and disgust faces, than to the happy or victory faces, consistent with pain being perceived as an avoidance signal. These findings informed our subsequent fMRI experiment probing correspondence with avoidant, right- lateralisation patterns.

Emotional content distracts us from (boring) tasks - but not those high on psychopathy

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Humans are good at focusing on a primary motivated task, but this can be easily and transiently disrupted when distractors of significant emotional content - either positive or negative - appear occasionally. Given the current debate about the role of emotion, attention and motivation for psychopathic personality, emotional distraction paradigms would be able to disentangle some of these factors. Across two studies, we implemented a cognitive control task with central distractors and an emotion induced blindness task, in University- based samples varying in self-reported psychopathic traits to explore how emotional distraction varies with different factors of psychopathy. Fearless dominance, but not other psychopathic traits, were associated with reduced distraction and reduced blinding by negative images. Neurophysiological correlates, however, did not mirror the behavioural effects of distraction, but did mirror the behavioural effects of emotion induced blindness. These results point to an emotion specific attention reduction and elucidates the emotion processing differences that are seen in psychopathy. The dissociation of neurophysiological correlates requires further investigation to derive the underlying mechanisms.

Serial Dependence in Consumer Decision Making

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Serial dependence refers to the tendency for perceptual judgments to be biased toward recently encountered stimuli, reflecting the brain's drive to maintain stability in perception. While well established for low-level features, recent work suggests that serial dependence also extends to higher-order evaluations, including aesthetic and preference judgments. In this study, we tested whether preference ratings for apparel exhibit serial dependence and whether this effect is modulated by individual differences in attitudes and habits. Across participants, we observed robust positive serial dependence: current appeal ratings were systematically biased toward the rating of the previous item. This bias followed a Difference-of-Gaussians (DoG) tuning profile, consistent with neural mechanisms of perceptual history integration. Further, DoG amplitude and bandwidth were selectively modulated by individual traits. Participants who valued personal appearance showed broader tuning (greater bandwidth), while those who prioritized comfort or frequently shopped online exhibited stronger assimilation (higher amplitude). These results extend serial dependence into the domain of fashion perception, highlighting how general-purpose brain mechanisms interact with individual differences to shape preference formation. They also underscore how sequential context influences consumer choices, linking the perceptual phenomenon of serial dependence to real world decision-making environments.

Is the lateralisation of language and visuospatial processing related to language comprehension ability in young children?

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For most adults, language is lateralised to the left hemisphere of the brain and visuospatial processing is lateralised to the right. Although deviations from this pattern are common in the general population and typically not associated with cognitive impairment, they occur more often in people with developmental language difficulties such as autism or dyslexia. Child neuroimaging studies suggest that these patterns of cerebral lateralisation, both typical and atypical, develop gradually throughout early childhood. However, few studies have investigated how language and visuospatial processing lateralise in young children or how they relate to language ability during development. We investigated the relationship between lateralisation patterns and verbal comprehension in a cross-sectional sample of young children. We recruited 127 young children aged between 4 and 7 years and used functional transcranial Doppler ultrasound (fTCD) to estimate the lateralisation of their language and visuospatial processing. The degree of crowding of both processes within one hemisphere was not related to verbal comprehension, nor was the overall strength of lateralisation. However, there was an interaction between age and typical lateralisation, such that verbal comprehension was significantly better for more typically-lateralised 4- and 5-year-olds. These findings suggest that verbal comprehension might be uniquely related to patterns of lateralisation, specifically during the 4 to 5 year developmental window. Possible explanations will be discussed, including the influence of education and language experience and the possibility that strategies for answering verbal comprehension test items, such as relying on mental imagery, may connect verbal comprehension with visuospatial processing.

Measuring the computational complexity of optimal choice via Fitness Landscape Analysis

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Human decision-making often involves tackling optimisation problems that vary significantly in their difficulty. To date, however, there is no general theory to granularly characterise the difficulty of optimisation problems and its effect on human decision quality. Here, we address this gap by characterising generic (task-independent) computational complexity metrics of optimisation problems employing Fitness Landscape Analysis (FLA), a framework from operations research. We test the applicability of these complexity metrics through several online

experiments. Participants are asked to solve several cases of a canonical computational problem (the knapsack optimisation problem) with varying levels of hardness (as characterised by FLA). We find that these metrics can account for a large proportion of the variance in human performance. Indeed, the model significantly captures differences in human accuracy and time spent on each instance of the problem, even on out-of-sample data. Our results highlight FLA as a promising framework for understanding the intrinsic complexity of cognitive tasks for humans. This study sheds light on people's information-processing limitations by providing a modelling tool to improve current decision-making models.

Cortical thickness changes during development in attention deficit hyperactivity disorder remission and persistence

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Background: We aim to address the Attention Deficit Hyperactivity Disorder maturational delay hypothesis by investigating cortical thickness changes during typical development and ADHD remittance or persistence.

Methods: 93 children underwent baseline (mean age 10.40 ± 0.44, 49.5% control) and follow-up (mean age 13.21 ± 0.62) T1-weighted MRI scanning and diagnostic assessment. Participants meeting criteria for ADHD at baseline were classified as persistent (24.7%) or remittent (25.8%) depending on follow-up diagnosis. FreeSurfer was used to preprocess and parcellate the cortex into regions of interest using the Desikan-Killiany atlas. Normative modelling was used to compute cortical thickness deviation values for each individual, accounting for age and sex (CentileBrain). Group prediction by changes in cortical thickness between baseline and follow-up was evaluated using logistic regressions, controlling for medication use.

Results: Persistent and remittent individuals show a higher increase in the left fusiform (Est = 1.20, p = 0.02) and left post central regions (Est = 1.50, p = 0.02) and a lower increase in the right insula (Est = -1.44, p = 0.02), left insula (Est = -1.24, p = 0.02), and left pars orbitalis (Est = -1.41, p = 0.01) compared to controls. The remitted ADHD group showed a lower increase relative to persistent individuals in the left transverse temporal (Est = -1.61, p = 0.03) and posterior cingulate regions (Est = -1.72, p = 0.03). However, none of these results survived FDR correction.

Discussion: Cortical thickness changes in somatosensory and executive regions relevant to ADHD could help predict ADHD diagnosis outcomes.

If the doors of self were cleansed: Effective connectivity of ego dissolution

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Ego dissolution (ED) is a key factor mediating positive clinical outcomes in psychedelic- assisted therapy. It also offers a unique lens for examining the neural basis of self-related processing. While prior neuroimaging studies have examined ED using functional connectivity, they have not addressed effective connectivity, namely, the directed causal influences between brain regions. This study aims to characterize effective connectivity differences between individuals reporting high and low ED, thereby advancing mechanistic understanding of self-disintegration under psychedelics.

Data are drawn from the PsiConnect trial. Spectral Dynamic Causal Modelling (spDCM), a Bayesian method that infers effective connectivity by fitting a biophysical generative model to the cross-spectral density of BOLD signals, was applied to resting-state fMRI data. The model included five regions implicated in self-processing and memory: parahippocampal cortex (PHC), hippocampus (HP), retrosplenial cortex (RSC), posterior cingulate cortex (PCC), and medial prefrontal cortex (mPFC).

We hypothesize that high ED will be associated with a breakdown in directed connectivity between the PHC and RSC, resulting in reduced top-down influence from the PCC and mPFC on the HP. These patterns are expected to correlate with MEQ Mystical subscale scores, whereas low-ED individuals will show stronger PHC–RSC connectivity and preserved network integration.

The anticipated findings support a mechanistic account of ED as a sequential decoupling within the autobiographical memory system—first between PHC and RSC, then between higher-order hubs and the HP—disrupting contextual binding and the integration of sensory input with higher cognitive representations and ultimately contributing to the dissolution of self-boundaries.

Sleep quality differentially moderates peripheral and central hearing effects on cognitive performance in older adults

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Hearing impairment and poor sleep quality are both prevalent, modifiable risk factors for cognitive decline. Although existing evidence recognises their individual effects, no previous studies have examined whether sleep quality moderates the relationship between hearing loss and cognitive performance. Data was drawn from 122 community-dwelling older adults (aged 60-90 years) from the MedWalk randomised controlled trial. Participants underwent assessments of peripheral hearing (pure-tone average), central hearing (signal-to-noise ratio), sleep quality (Pittsburgh Sleep Quality Index; PSQI), and cognitive performance (Cambridge Neuropsychological Test Automated Battery). Moderation analyses using generalised linear models examined the interactions between hearing and sleep across individual cognitive domains, controlling for age, sex, and education. Results showed sleep quality significantly moderated these relationships, with the effects differing by hearing type and cognitive domain. For peripheral hearing loss, poorer sleep quality was associated with reduced accuracy on first attempts and increased total errors on the Paired Associates Learning task. For central hearing loss, poorer sleep quality was associated with worse performance on spatial working memory and complex reaction time tasks. Notably, a threshold effect emerged, where poor sleep quality (PSQI > 5) was associated with substantially greater associative learning errors only in individuals with moderate or greater peripheral hearing impairment. These findings support a multi-factor approach to cognitive aging, suggesting that combined interventions targeting both hearing and sleep may be more effective than addressing either factor alone.

This research was supported by an NHMRC grant (GNT1171300) and a PhD scholarship, jointly funded by Specsavers and Swinburne University of Technology.

Disentangling Bayesian computations versus Bayesian-like heuristic strategies using prior-likelihood metamers

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Bayesian decision theory proposes that people make statistically rational decisions by combining accumulated knowledge (priors) with sensory information (likelihoods). This framework has been successful in explaining many aspects of human behaviour. However, there is debate over whether people perform precise Bayesian computations or instead rely on less demanding strategies—such as approximations or heuristics—that produce behaviour resembling Bayesian predictions. To address this, we examined people's sensitivity to metamers: different combinations of prior and likelihood distributions that yield identical optimal decision policies. A precise Bayesian observer would be expected to show a temporary drop in performance immediately after a switch, followed by recovery to pre-switch accuracy, reflecting the updating of the prior representation. Participants (N = 71) were trained to estimate the hidden locations of targets drawn from a Gaussian prior.

On each trial, scattered dots provided likelihood information about the target's location. Over time, participants learned the prior distribution and combined prior and likelihood information to infer target locations. We then covertly introduced an untrained prior–likelihood metamer pair. Unlike precise Bayesian observers, participants' performance declined after the switch and the decline persisted for the entire period during which the untrained pair was presented ($z = 5.75$, $p < .001$). This finding challenges a strict Bayesian interpretation of task performance, suggesting that participants may instead rely on likelihood-sensitive heuristics that do not fully integrate prior information. Our study demonstrates how metamer manipulations can disentangle behaviour that merely appears Bayesian from behaviour that is genuinely produced by Bayesian computations.

Gallery Glimpse: A naturalistic video game task to test neural mechanisms of memory development

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Empirical episodic memory studies largely rely on tasks with strict experimental parameters. While this work has advanced our understanding of memory formation, extant findings do not adequately translate to naturalistic conditions involving exploration and everyday distractors. To address this gap, we created Gallery Glimpse, a video game that captures naturalistic memory encoding in an environment appropriate for stationary research participants, i.e. intracranial electroencephalographic (iEEG) patients. Gallery Glimpse is designed to test event and event-context association memory while exploring a museum. It is accessible for basic literacy populations, including pediatric iEEG patients. This study will establish normative behavioral data on the game in a healthy developmental cohort. We hypothesize that event and associative memory will follow a parabolic trajectory of improvement from childhood - young adulthood, plateau during young adulthood, and gradual decline with advancing age, with stronger effects for associative versus event memory. We present preliminary data from 64 participants aged 6-57 years (majority aged 16–31, 3 children <16). A linear mixed effects model with fixed effects of memory-type and age on accuracy (d') revealed a main effect of memory type where event was better than associative memory ($F(1,126)=345.63$, $p<.001$). Additionally, an age by memory-type interaction suggested that event memory worsens with age ($F(1,126)=3.91$, $p=.05$), an effect not replicated in associative memory. This interaction contradicts our hypothesis, likely due to under-sampling of children. Robust sampling of children and older adults is needed to fully examine our hypothesis and establish normative data to test against pediatric - adult iEEG cohorts.

A Novel Ecological Foraging based Paradigm for Studying Integrated Cognition in Schizophrenia

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Schizophrenia, affecting ~1% of the population, has diverse symptoms, multifactorial causes, and varied pathophysiology, making it challenging to study. Prior research has utilized behavioural tasks that capture single cognitive functions like working memory, belief updating, or reward processing—but misses how these systems interact to shape behaviour in real world contexts. We developed a dynamic, ecologically valid behavioural paradigm inspired by patch foraging, in which participants harvest rewards (berries) from multiple depleting and replenishing options (trees) that can be freely revisited. We hypothesised that successful performance would require the integration of working memory (tracking multiple options) and belief updating (adjusting quality estimates). Fifty-three healthy adults (18–24 years) completed the foraging task, along with the beads task (belief updating), Corsi Span task (working memory), and a self-reported schizotypal traits survey. Participants with lower draws-to-decide (DTD) in beads task, indicative of updating beliefs with less evidence, achieved higher foraging performance, earning more rewards ($t= 2.62$, $p= .012$, $d= 0.78$) and fewer visits to poor options ($t= –2.13$, $p= .041$, $d= –0.68$). Those with higher working memory span (Corsi Span

task) showed faster initial harvesting (t= 3.03, p= .009, d= 1.08) and greater rewards (t= 2.19, p= .050, d= 0.95). These findings validate the foraging task for studying integrated cognition and show that adaptive belief updating and strong working memory benefit in dynamic environments. Analysis for the effect of schizotypal traits is ongoing. This paradigm holds promise for investigating behavioural and neural mechanisms in psychiatric disorders like schizophrenia.

Is my favorite colour your favorite colour?

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A fundamental question in consciousness is whether individuals experience colours in the same way. One approach towards answering this, the qualia structure approach, tackles this problem by focussing on relationships between the experiences. Within this approach, investigation of participant-reported similarities between colour experiences has found that the resulting similarity structures can be aligned across individuals without using colour labels, reliably matching each colour in a given participant to its corresponding objective colour in other participants. While this supports the idea that colour experiences are consistent across people (i.e. my red is indeed your red), it leaves open a clear question: if colour experiences are the same across people, how is it that people can have different favourite colours? Here, we consider that similarities alone do not fully capture relationships among experiences, and investigate preference ratings as another form of relationship. We presented participants (N=19) with pairs of colours at a time and asked them to rate how similar they felt the two colours were, along with how strongly they preferred one colour over the other. We find preference rating patterns to be more varied across participants than for similarity ratings, as indicated by lower matching of objective colour labels during alignment. Despite this, we find lower alignment distances among preference structures than for similarity structures. These results suggest that preference ratings do not derive directly from similarity ratings, and leave open the possibility of colour experiences being different, or inverted, across people when considering relationships other than similarity.

Tactile discrimination on the abdomen and forearm in pregnancy: a two-point discrimination study

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Representations of the body in the brain are formed and reinforced by sensory input from the represented body part. Pregnancy involves rapid and intense physiological changes which may impact sensory perception. It is unknown whether the abdomen becomes more sensitive due to increased sensory input and attention to sensation or less sensitive due to a third trimester analgesic affect or reduced receptor density. This study aimed to investigate tactile discrimination on the abdomen and forearm in a sample of 26 third-trimester pregnant and 20 never-pregnant women.

Digital callipers were applied to the forearm and abdomen, with a staircase procedure used to identify the minimum distance at which participants consistently reported feeling two points rather than one. Thresholds were estimated as the minimum "two points" associated with consistent "two-point" and "one-point" reports, and the first three reports for each body part were averaged.

A two-way mixed ANOVA was conducted to examine the effects of pregnancy status and location (abdomen, forearm) on mean two-point discrimination. A significant interaction was found between pregnancy status and location (p=.004). Post-hoc tests revealed that tactile sensitivity on the abdomen was significantly reduced in pregnancy compared to controls (p=.006), while forearm sensitivity was similar across both groups. Significant location effects were also observed in both pregnant (p=.03) and control (p=.04) groups, revealing differences in sensitivity in the abdomen compared to the forearm.

Reduced tactile sensitivity during pregnancy may reflect neuroplastic adaptations in somatosensory processing. Functionally, this could influence protective responsiveness to abdominal stimuli and body awareness more broadly.

OSCILLATE: A large-scale cohort study in Deakin's Cognitive Neuroscience Unit

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Research in the cognitive neuroscience field is often plagued by small sample sizes, incomplete measurement of participants, and a lack of developmental/longitudinal work. This has hindered the generalizability of available research, and led to a "replicability crisis", whereby a significant number of published studies cannot be reliably reproduced by other researchers. Collectively, these limitations have meant that the relationship between behaviour, cognition and biology, and the contribution of the neuro-cognitive systems to typical and atypical development, have been largely inadequately characterised. This gap in the field's foundational knowledge also restricts any potential for clinical and community translation. In an effort to address these limitations, the Cognitive Neuroscience Unit at Deakin University has developed a research project called OSCILLATE, which aims to establish a community-based "cohort" of participants, both typically developing and clinical (i.e., neurodevelopmental disordered), that over time will provide a rich research resource of sufficient sample size and phenotypic scope to address the above-mentioned limitations of cognitive neuroscience research. This presentation will outline the purpose of OSCILLATE, the methodology employed, and provide a summary of the data we have collected to date. It will also outline how we have designed OSCILLATE to feed into Deakin's School of Psychology undergraduate, fourth-year and higher degree by research program, in an effort to enhance the lab-based research training experience.

Contribution of Cerebral Small Vessel Disease and Plasma Biomarkers to Default Mode Network Functional Failure along the Alzheimer's Disease Continuum

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Cerebral small vessel disease (CSVD) contributes to Alzheimer's disease (AD) alongside amyloid-beta (AB) and tau pathologies, with the functional connectivity (FC) of the default mode network (DMN) being particularly vulnerable. This study investigated the relationship between DMN-FC, using the network failure quotient (NFQ), plasma-extracted AD biomarkers, and CSVD. We analysed three subgroups from the ADNI database: cognitively normal (CN; N = 142), mild cognitively impaired (MCI; N = 84), and AD (N = 59). All participants had structural and fMRI scans, plasma markers (AB42/AB40 ratio, p-Tau217), and clinical assessments.

Segmented grey matter and white matter fractions (GMF, WMF) were normalised to each participant's intracranial volume. One-way ANOVA and univariate linear regression examined NFQ group differences and linear relationships between each predictor and NFQ. Stepwise multivariate linear models assessed the combined effects of tissue-specific atrophy, CSVD, AD plasma biomarkers, and cardiovascular risk factors (CVRFs). Results showed significant group differences in NFQ ($p < 0.001$), with AD exhibiting the highest NFQ. Univariate regression revealed significant associations between NFQ and age ($p < 0.01$), total WMH ($p < 0.04$), GMF ($p = 0.03$), WMF ($p < 0.01$), AB42/AB40 ratio ($p < 0.01$), and p-Tau217 ($p < 0.01$). GMF and WMF were the only significant predictors both before ($p = 0.02$ and $p < 0.01$) and after ($p = 0.01$ and $p < 0.01$) adjusting for diagnosis, demographics, and CVRFs. Our findings support a model where tissue-specific structural breakdown relates to DMN-FC failure independent of amyloid/tau and CSVD burden.

Position representations of predictably moving visual objects are unaffected by spontaneous lapses in sustained attention

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Sustaining attention on our dynamic visual world requires the brain to continually update its positional representations of moving objects. Of course, sometimes attention spontaneously lapses, which often disrupts goal-directed behaviour. Here, we investigated the extent to which these lapses affect low-level positional representations of a moving object. We recorded electroencephalography from human participants who covertly monitored a dot that smoothly moved around a central fixation point. We probed whether participants were sustaining their attention on the dot using subtle and unpredictable target flashes, which they needed to localise at the end of each trial. Our preliminary results suggest that missed targets were preceded by increases in posterior alpha power and failed to evoke event- related potential components that were present for hits—effects characteristic of an attentional lapse. We then used forward encoding models, trained on independent static localiser data, to extract positional representation maps of the moving dot over time. To our surprise, we found no differences in pre-target representations between hits and misses. By contrast, post-target representations were sustained at the target location for hits but not misses, likely reflecting the maintenance of the detected target location in working memory. Collectively, this work suggests that attentional lapses may not affect the positional representations of predictably moving objects but instead gate the encoding and maintenance of other task-relevant stimulus changes.

This work was funded by an Australian Research Council Discovery Project awarded to ANR (DP220101067).

The role of visual awareness and specific phobias in physiological reactions to evolutionary threatening animals

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Previous research has found an advantage in the unconscious processing of snake and spider images, evidenced by enhanced detection abilities and stronger electrodermal activity. Additionally, individuals with specific phobias tended to show heightened behavioural and autonomic responses. However, the existence of an advantage in unconscious processing of evolutionarily threatening animals has not been widely supported. We used breaking Continuous Flash Suppression to subliminally present images of spiders and snakes for extended periods, alongside their phase-scrambled versions as control stimuli. We recorded the time required for stimuli to break through suppression, as well as various physiological

indices, including skin conductance, pupil dilation, and facial electromyography. To explore individual differences in physiological and behavioural responses, we also measured participants' levels of specific phobias using the Spider Fear and Snake Anxiety questionnaires. We found an advantage in breakthrough times for snake stimuli compared to spider stimuli, with faster responses for intact images than their scrambled versions. Although spiders did not demonstrate a similar advantage in visual processing, they still influenced autonomic arousal. Specifically, both snake and spider stimuli elicited stronger electrodermal responses and greater pupil dilation compared to their scrambled counterparts, even before the stimuli reached conscious awareness. Notably, the spider phobia group exhibited a higher electrodermal response to spider stimuli than to scrambled images, but this occurred only after the stimulus reached conscious perception. Overall, our findings support the existence of a subcortical pathway that facilitates pre-attentive processing of phobic stimuli, and they reveal different processing styles in individuals with specific phobias.

Probing the Craving Neurocircuitry in Cannabis Use Disorder Using Real-Time fMRI Neurofeedback

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Cannabis Use Disorder (CUD) affects approximately 50 million individuals globally and is linked to a range of negative psychosocial and health outcomes, which have been ascribed (in part) to hyperactivity in the craving neurocircuitry including the anterior cingulate cortex (ACC) amongst other regions. However, how craving-related function changes in real time remains unexamined, leaving prominent neurobiological theories of addiction untested in CUD. We investigated whether real-time functional MRI neurofeedback (fMRI-NF) can be used to volitionally engage the craving neurocircuitry in CUD, with a focus on the ACC.

Ten individuals with moderate-to-severe CUD were tested at the 7 Tesla MRI at the Melbourne Brain Centre Imaging Unit (MBCIU). Participants completed: (i) a "localiser" cue-reactivity fMRI task to identify which part of the ACC (i.e., ROI) was most consistently engaged at the individual level; (ii) two fMRI neurofeedback runs to up-regulate ROI activity via increasing the height of a "craving bar" displayed via a screen in the scanner, showing the % signal change participants achieved in the ROI. Group-level data was analysed using whole-brain and ROI-based general linear models.

ROI analysis results showed that the ACC activity decreased during up-regulation ($t = -6.57$, $p < .05$), comparing to neutral blocks. Whole-brain analysis results (Upregulation > Neutral) showed significant deactivation across frontal ($t = 9.76$, $p < .05$) and parietal ($t = 11.50$, $p < .05$) regions.

The findings suggest previously unrecognised plasticity in craving-related networks, differing from prominent neuroscientific theories of addiction, and need to be validated in larger samples.

Ketamine effects on EEG and their links to therapy differ across treatment-resistant major depression, post-traumatic stress disorder, and obsessive-compulsive disorder

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Background. Should psychiatry lump or split or both? Neurotic disorders – major depressive disorder (MDD), panic disorder, social anxiety disorder, generalized anxiety disorder, obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), and specific phobia – have differing pharmaceutical profiles. But all, even when resistant to conventional treatment (TR), respond quickly to low dose ketamine. We explore the similarities and differences in the neural effects of ketamine across its treatments of TR-MDD, TR-PTSD and TR-OCD.

Methods. We recorded 10-minutes' resting frontal activity, and diagnosis-related scale measures, before and 2 hours after fentanyl (50mcg) or ketamine (0.5 or 1.0 mg/kg, I.M.) counterbalanced across three sessions at least a week apart. Average power spectra were calculated for delta, theta, alpha1, alpha2, beta and gamma bands. ANOVA compared TR- PTSD (20♀, 2♂) with TR-MDD (12♀, 13♂). Preliminary TR-OCD (5♀, 2♂) data were also obtained.

Results. Power variation across ketamine dose, band frequency, and electrode position differed significantly between TR-MDD and TR-PTSD, with TR-OCD qualitatively different from both. The correlation of power change with scale score change was maximal for different bands and electrodes across the Impact of Events Scale-Revised, Montgomery- Asberg Depression Rating Scale, Hospital Anxiety and Depression Scales, Hamilton Anxiety Scale, Fear Questionnaire and Yale-Brown Obsessive-Compulsive Scale.

Conclusions. Ketamine effects and their therapeutic links both vary in band and site with DSM diagnosis – consistent with TR anxiety results and with our double-hit model of neurotic disorders. On this view, a ketamine-sensitive factor generally and indirectly changes the disorder-specific systems that conventional treatments target selectively and directly.

Optimizing the clinical effectiveness of TBS treatment of depression (OPTI-TBS): A clinical randomised controlled trial

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Major Depressive Disorder (MDD) is a prevalent mental health condition, with ~30% of those diagnosed experiencing treatment-resistant depression (TRD). Repetitive transcranial magnetic stimulation (rTMS) is effective for TRD, but research attempting to understand the most effective and efficient stimulation parameters is ongoing, including how best to provide treatment with intermittent theta burst stimulation (iTBS) protocols. This trial examined whether higher-dose iTBS enhances outcomes, and whether continuous delivery outperforms spaced delivery (with breaks between blocks of iTBS). In a three-arm, double- blind, randomised, multi-site trial, 67 participants with TRD received either standard iTBS (600 pulses), extended continuous iTBS (1800 pulses), or extended spaced iTBS (three 600- pulse blocks with 5-min intervals). Depression severity (Hamilton Depression Rating Scale, HAMD; Patient Health Questionnaire, PHQ), anxiety (Beck Anxiety Inventory, BAI) and quality of life were assessed at baseline, during treatment, and up to 6 months post- treatment. For the HAMD, linear mixed models showed a significant effect of time ($p < 0.01$) but no group effect ($p = 0.676$). For the PHQ, both a significant effect of time ($p < 0.001$) and a significant time ×

group interaction ($p < 0.001$) were found, with the extended continuous group demonstrating greater symptom reduction than the other groups at 6 months. While researcher-rated symptoms (HAMD) did not differ by protocol, patient- reported outcomes (PHQ) indicated sustained improvement with extended continuous iTBS. These findings support the potential for higher-dose continuous stimulation to produce longer-term benefits in TRD, warranting further investigation into optimised dosing strategies.

Investigating Perruchet's dissociation between performance and expectancies in the flanker task

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In conflict tasks, differences in performance between incongruent and congruent trials (i.e. the congruency effect) are influenced by recently experienced trials. For instance, congruency effect is larger after a sequence of congruent trials than after a sequence of incongruent trials. While it has been argued that these congruence sequence effects are driven by expectations for the next trial's conflict, Jiménez and Méndez (2013) demonstrated that congruence sequence effects in the Stroop task could be dissociated from explicit expectancy using a dissociation known as the Perruchet effect (see Perruchet, 2015), suggesting such effects are automatic. In this study, we investigated whether flanker interference operates under similar principles. In each experiment, participants were given a variant of the Eriksen flanker task with 50% congruent and 50% incongruent trials, and were asked to rate their expectancy for events on the next trial. We manipulated the expectancy question and its delivery between trials to investigate how concurrent monitoring and rating of expectancies influenced the congruence sequence effect. Our results demonstrate highly robust effects of conflict history that are dissociable from expectancies.

Acute exposure to hypoxia impairs navigational ability and slows alpha and beta EEG activity but not aperiodic EEG activity

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The differential impact of low-oxygen exposure (hypoxia) on cognitive performance is in part dependent on the context of exposure, with intermittent hypoxia (IH) often producing beneficial effects and continuous hypoxia (CH) generally impairing performance. However, effects on complex cognitive functions such as navigation remain unclear. This study examined the impact of 1-hour CH or IH exposure on virtual reality navigation and associated EEG activity. Seventy-two healthy participants (CH = 51, IH = 21) completed pre- and during-exposure assessments. EEG (eyes-open/closed) was recorded from 7 electrodes, and navigation was tested using

the Spatial Performance Assessment for Cognitive Evaluation (SPACE) tool, comprising path integration, egocentric pointing, mapping, and perspective-taking tasks. Periodic and aperiodic EEG activity were extracted using SpecParam, and mixed-effects models assessed hypoxia effects. Hypoxia increased distance and angle error compared to sham in both CH and IH. Egocentric Pointing was unaffected by hypoxia. Mapping performance (R^2) was reduced under hypoxia in IH and improved with age. Perspective-Taking angle error was greater under hypoxia during CH. For EEG, hypoxia reduced alpha central frequency in CH, with no effect on alpha power. Beta central frequency was reduced in CH under hypoxia, while beta power was lower in hypoxia than sham and in IH compared to CH. Aperiodic exponent and offset were unaffected. Hypoxia selectively impaired navigational ability and altered oscillatory dynamics in an intervention- and task-dependent manner. These findings have implications for navigating environments with reduced oxygen availability, such as high altitude, or in populations where hypoxia is experienced due to pathology.

Intrinsic Universal Structures and Extrinsic Local Functions

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Recent advances in consciousness neuroscience have exposed a critical impasse: competing theoretical frameworks, structuralist vs. functionalist (Fleming & Shea 2024, 2024b; Song 2024, Ellia & Tsuchiya 2024; Kleiner 2024), universal vs. local (Albantakis et al. 2023; Kanai & Fujisawa 2024; Fleming 2024); intrinsic vs. extrinsic (Cohen and Dennett 2011; Doerig et al. 2019; Tsuchiya et al 2020; Negro 2020; Ellia et al. 2021), appear to be inducing philosophical deadlocks and conceptual standstills. While these debates have generated valuable insights, they have proceeded in parallel, without a systematic understanding of their relationships and implications. In this contribution, we argue that these parallel disputes reflect deeper, unresolved tensions in conceptualizing consciousness. Thus, we argue that these debates can be resolved by introducing a meta-theoretical framework composed of three fundamental dimensions that encompass all models of consciousness: (1) intrinsic (first-person) vs. extrinsic (third-person) perspectives, (2) universal (substrate- independent) vs. local (human-specific) scope, and (3) structure (formal organization) vs. function (cognitive roles) as explanatory priorities. These dimensions interact in revealing ways. Understanding these interactions helps reveal potential blind spots in current frameworks. Our analysis reveals a fundamental clustering into extrinsic-local-functional and intrinsic-universal-structural approaches to consciousness, suggesting that theoretical conflicts reflect deeper methodological commitments rather than empirical disagreements, offering new pathways for investigation and transforming apparent deadlocks into tractable disagreements about dimensional priorities. Thus, our framework's impact extends beyond theory, bridging the gap between foundational debates and translational applications.

The Impact of Target Genuineness and Participant Task on the Speed of Face Detection

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Previous research has shown that naturalistic facial expressions are perceived as more genuine than posed facial expressions. We sought to determine whether this increased genuineness affects how quickly faces are detected in a fast saccadic choice task. Participants (N=40) were presented with one face and one object image either side of an initial fixation spot and were instructed to quickly look at a target. The emotional expression of the face stimuli was manipulated across trials. Additionally, half the trials had faces drawn from a set of naturalistic stimuli, and half had faces drawn from a set of posed stimuli. We monitored eye movements and analysed average correct reaction time. While we found the expected advantage for face targets over object targets, naturalistic and posed expressions elicited similar performance, suggesting that target genuineness did not impact the speed of face detection. We found no advantage for negative face targets over neutral face targets in Experiment 1, which questioned whether a detection advantage for negative expressions over neutral expressions exists when employing naturalistic stimuli. In Experiment 2 (N=60) we used a similar experimental approach, except we presented pairs of faces and manipulated task relevancy. We also manipulated the target expression (pain, angry, and neutral), and the target gender (masculine and feminine).

We found a speed advantage for face targets expressing negative emotions, particularly when the facial expression was task relevant. Collectively, these results support a detection advantage for faces expressing negative emotions, even when using a diverse range of naturalistic stimuli.

Age and sex differences in neuro-psychometric networks of cognition, emotion and brain structure

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Neuro-psychometric networks (NPNs), which combine psychometric and structural covariance data, provide a novel framework for examining the complex relationships between the mind and the brain to inform targeted interventions for clinical and general populations. Applying Network Comparison Tests (NCTs) to NPNs may further enable personalised approaches by identifying differences related to age and sex. Study 1 analysed Human Connectome Project (HCP) Aging data, comparing middle-aged (n=380, 36–59 years) and older-aged (n=339, 60–100 years) adults. Study 2 used HCP Developmental, Young Adult, and Aging datasets to compare males (n=812, 18–100 years) and females (n=1019, 18–100 years). Networks of seven cognition nodes, four emotion nodes, and 12 cortical regions were estimated via graphical lasso with EBIC tuning. Bridge strength centrality identified nodes bridging layers, and NCTs assessed group differences. Age groups showed no network-level differences, though working memory differed in bridge strength (p=0.01). Qualitative differences in bridge node rank order were also observed; anger was top-ranked in middle age, whereas sadness ranked highest in older age. Sex- based comparisons revealed a significant difference in global strength (p=0.02) that was not significant after controlling for age (p=0.17). The left rostral anterior cingulate was top- ranked for males and females, however, differences were found in the order of the subsequent top-ranked nodes. These results illustrate how NPNs and NCTs can reveal both statistical and qualitative group differences in the context of complex network relationships, offering valuable insights for tailoring strategies to support mental health and cognitive function across the lifespan.

Testing the prevalent consistency assumption of (un)conscious processing through massive feature extraction of inattentional blindness EEG

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Freud's iceberg metaphor has long been used to describe (un) consciousness: a huge unconsciousness supports a tiny tip of consciousness. Inspired by this metaphor, research on (un) consciousness has assumed consistency of neural coding for (un)conscious perception, employing contrastive analysis to isolate the neural correlates of consciousness (NCC). For example, in electroencephalography (EEG) studies, features of time series are related to unconscious sensory processes if they discriminate the presence of invisible visual stimuli. According to the consistency assumption, these features should also discriminate these stimuli when they become visible and task relevant. Despite the prevalence of the assumption, it has never been directly questioned, and whether it is generally true for EEG studies, regardless of the exact analysis method employed, is unclear. This registered report aims to explicitly test this assumption by utilising a toolbox providing over 7000 time-series features from various analysis methods from a wide range of research fields. We apply these features to an inattentional blindness paradigm and identify features which significantly discriminate the presence of a visual stimulus which is initially invisible, and then later visible and task relevant. We track the performance of each feature in discriminating the presence of the stimuli as it varies in visibility, and use a Bayesian framework to test whether the consistency assumption is likely to be valid in general. Pilot results suggest that the assumption is likely to be invalid across the range of time-series features.

How explicit and implicit feedback shape L2 learners' anxiety in real-time communication:An fMRI study

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Corrective feedback is central to second language (L2) acquisition. While it facilitates linguistic development by guiding learners to notice and revise errors, it can also shape brain's socio-emotional processes during real-time communication, a key factor hindering communication fluency and confidence.

This fMRI study examined how explicit feedback (EF; "you should say 'went', not 'goed'") and implicit feedback (IF; recasts, e.g., "you went to a concert") modulate neural and emotional responses during real-time L2 conversations.Fourteen Japanese learners of English engaged in L2 English dialogues under three conditions: no feedback (control), EF, and IF.

Whole-brain analysis revealed a tendency toward greater activation in the orbital part of the left inferior frontal gyrus under EF > control (uncorrected p< .001), suggesting recruitment of neural circuits involved in both cognitive and socio-emotional processing. A theoretically driven ROI analysis of the amygdala revealed no significant group-level activation differences but showed marked individual-difference effects. Under EF > control, left amygdala activity positively correlated with both L2 communication anxiety(r=.46) and fear of negative evaluation (FNE) (r=.47). Under IF > control, left amygdala activity positively correlated with FNE(r=.46), and right amygdala activity with communication anxiety (r=.60).

These findings suggest that even "milder" feedback such as recasts can engage emotion- related neural circuits in anxious learners. The results highlight the role of individual affective profiles in shaping neural responses to feedback and provide neurocognitive evidence that corrective feedback—explicit or implicit—is not purely informational but also socio-emotionally salient, with implications for tailoring strategies to support emotionally sensitive L2 learners.

Pain interference in daily life is associated with over-reliance on prior beliefs in judging the pain of others

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Bayesian inference theory postulates that perception occurs through combining our senses (likelihood) with beliefs (priors). We investigated whether personal experience with pain shapes pain evaluation and how people integrate likelihood and priors to judge the pain of others. We hypothesised that people with more severe chronic pain would rely more on prior beliefs and less on sensory information when judging pain experienced by others. This pre-registered study (https://osf.io/mnpt9) involved a pain version of the "coin task" (Vilares et al., 2012). Participants were required to integrate uncertain sensory information (pain ratings) with prior knowledge (rating accuracy) presented in a two-by-two factorial design. We computed the Global Sensory Weight, a computational parameter reflecting the degree to which an individual relies on sensory vs. prior information when making perceptual judgments. Pain was measured using the Brief Pain Inventory (BPI), evaluating pain severity and its impact on daily life, or interference (Cleeland & Ryan,1994). In our a priori power analysis, we estimated 80% power to detect r= -0.15 at p<0.05 (1-sided) with N=237. While due to technical difficulties, complete datasets were available only from N=152, the expected effect size was achieved. Greater BPI correlated with smaller Global Sensory Weight (r=-0.15, 1-tailed p=0.03, df=142), driven by the interference (r = -0.18, 2-tailed p = .029) rather than the severity (r = -0.14, 2-tailed p =0.25) of pain. Overall, these results suggest that the degree to which experiencing pain affects daily life activities is associated with an overweighting of prior beliefs relative to sensory information.

Investigating 'where', 'when', and 'how' direct current stimulation modulates information encoding by prefrontal neurons, to lead to the changes in cognitive functions

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Transcranial direct current stimulation (tDCS) has garnered significant interest for its potential to enhance cognitive functions and as a therapeutic intervention in various cognitive disorders. However, the clinical application of tDCS has been hampered by significant variability in its cognitive outcomes and our limited understanding of its underlying neural mechanisms at the cellular level. We still do not know 'where', 'when', and 'how' tDCS modulates information encoding by neurons, to lead to the observed changes in cognitive functions. We investigated the effects of tDCS, applied over the dorsolateral prefrontal cortex (dlPFC), on cognitive abilities and individual neuron activity in animal models.

Anodal tDCS attenuated subjects' behavioural and neuronal adaptations when compared to sham. Furthermore, tDCS abolished the correlation between subjects' response time and neuronal firing rate. At a single-cell level, we also found that following tDCS, neuronal firing rate was more likely to exhibit task-specific modulation than after sham stimulation. These tDCS-induced changes in both behaviour and neuronal activity persisted even after the end of tDCS stimulation. We show that modulation of behaviour by the tDCS is accompanied by alterations in prefrontal cortical cortical cell activity ('where') during distinct trial phases ('when'). Importantly, tDCS led to task-specific and state-dependent alterations in prefrontal cell activities ('how'). Our findings suggest a significant shift from the view that the tDCS effects are merely due to polarity-specific shifts in cortical excitability and instead, propose a more complex mechanism of action for tDCS that encompasses various aspects of cortical neuronal activity.

Effects of cognitive noise on the temporal dynamics of risky choices

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Real-life choices often require striking a balance between the value of choice outcomes and their likelihood. When taking out flood insurance, for example, it is important to consider both the cost of any damage and the probability of flooding. 'Rational choice theory' assumes that risky choices rely on an optimal integration of choice values with their probabilities. The literature, however, is replete with examples of irrational, biased choices, and these observations have motivated piecemeal modifications of the theory. A recent 'cognitive imprecision theory' can account for most reported biases in a principled fashion by assuming that noisy subjective representations of choice value and probability are integrated optimally. Here, we developed a novel perceptual game to test a key prediction of this theory, namely, that the temporal dynamics of risky choices and their neural correlates should co-vary with cognitive noise. Forty healthy, adult humans first estimated the average orientation of a briefly presented circular array of twelve differently oriented gratings and then chose to either play the game or not (risky and safe choices). If they chose to play, they were awarded points proportional to the average orientation in that trial. Noise was manipulated by randomly switching between high and low variability in the orientations of displayed gratings. Computational modelling of behaviour showed that cognitive noise impacted estimates of loss and risk aversion. Similarly, multivariate feature-specific analyses of functional brain activity showed an effect of noise on the precision of neural value representations, lending neurobiological support to the cognitive imprecision theory.

Ketamine's Neural Signatures in Treatment-Resistant Depression and PTSD: A Resting-State EEG Study

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Treatment-resistant Major Depressive Disorder (TR-MDD) and Post-Traumatic Stress Disorder (TR-PTSD) remain pressing challenges in psychiatric care due to poor response to conventional therapies. Ketamine, a novel rapid-acting glutamatergic agent, has shown promise in alleviating symptoms across a range of neurotic disorders. This study aims to investigate ketamine-induced modulation of brain activity using resting-state electroencephalography (EEG) in individuals diagnosed with TR-MDD and TR-PTSD.

Participants with TR-MDD and TR-PTSD received either low- or high-dose intramuscular ketamine or an active control (fentanyl) across a three-week protocol. EEG recordings (16-channel) were collected at baseline, 2 hours, and 24 hours post-dosing. Resting-state EEG was analysed with a focus on neural oscillatory dynamics, using power spectral and topographical methods to examine cortical activity changes over time and across conditions.

Early findings indicate ketamine-induced modulation of cortical oscillatory activity across both diagnostic groups. These changes appear to be both dose- and time-sensitive and are spatially distributed across brain regions implicated in mood regulation and emotional processing. Comparative analysis between TR-MDD and TR-PTSD groups suggests common as well as disorder-specific neural signatures of ketamine's effects.

This ongoing study supports the utility of EEG as a non-invasive tool for tracking neural modulation following ketamine administration. It aims to contribute to the identification of potential electrophysiological biomarkers for treatment response in resistant depressive and stress-related disorders. The results may also inform neurobiological theories distinguishing general neurotic mechanisms from disorder-specific pathways, potentially guiding future treatment strategies and personalized interventions.

Stimulating connections: Personalised Theta Burst Stimulation in Alzheimer's

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Growing evidence implicates neural network dysfunction, particularly within the default mode network (DMN) and frontoparietal network (FPN), as a key mediator linking neural pathology to the clinical symptoms of Alzheimer's disease (AD). Disrupted connectivity within these networks is consistently observed in AD and correlates with cognitive impairment. Previously, our proof-of-concept trial demonstrated that targeting network dysfunction with intermittent theta burst stimulation (iTBS) improved delayed recall in individuals with mild-to-moderate AD, with these results also suggesting that personalising stimulation parameters may enhance efficacy.

We are now conducting a double-blind, parallel, randomised, sham-controlled trial investigating the impact of 12 weeks of personalised iTBS in mild-to-moderate AD. Stimulation is individualised both in terms of pattern of stimulation and cortical target, in order to optimally engage sites within the DMN (bilateral angular gyrus) and FPN (bilateral middle frontal gyrus of the DLPFC). Neurobiological data (fMRI, fNIRS, EEG) and plasma biomarkers are gathered before and after treatment, with cognitive and behavioural assessments conducted before, during, and after treatment.

In this presentation, we report preliminary fMRI results from the first 20 participants who completed the treatment course, focusing on iTBS-mediated changes in DMN and FPN connectivity in the active group relative to the sham group. These findings inform the potential of personalised iTBS as a therapeutic approach for AD, both as monotherapy and as an adjunct to emerging disease-modifying treatments. Our research supports further investigation of circuit-based neuromodulation strategies to optimise cognitive outcomes in AD.

All proficient foreign language learners resemble native readers, whereas each less proficient learner struggles in their own distinct way

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A longstanding debate in bilingualism asks whether foreign language (FL) learners achieve proficient reading by developing native-like mechanisms (accommodation) or by relying on first language processes (assimilation). Predominantly shaped by word recognition studies, this debate lacks evidence from natural reading, which integrates grammar and context to provide insights into real-life reading and may hold the key to its resolution. This study addresses this gap by examining natural reading in English among native speakers and Chinese-speaking English learners, using integrated eye-tracking and functional magnetic resonance imaging (fMRI) datasets. Fixation-related brain activation analyses replicated established reading networks and revealed both shared and distinct brain regions between groups. Exemplar-based pattern similarity analyses showed that FL learners whose activation patterns more closely resembled those of native readers—or of high-proficiency FL learners—demonstrated better eye-movement performance (shorter total reading times and regression-path durations). However, similarity to high-proficiency FL learners did not predict eye-movement measures once similarity to native readers was controlled, indicating that proficient FL reading primarily mirrors native readers' neural patterns. In contrast, similarity to low-proficiency FL learners was not associated with poorer performance, suggesting no common neural signature among less proficient readers. These findings support the accommodation hypothesis: high-proficiency FL learners converge toward native-like brain activation during natural reading, whereas low-proficiency learners exhibit heterogeneous neural strategies. This study is the first to investigate the neural mechanisms underlying natural reading in FL learners by integrating eye-tracking and fMRI techniques, providing key insights into FL processing and learning.

Comparison of neural networks for Tourette syndrome and related disorders: a network mapping approach

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Most patients diagnosed with Tourette syndrome (TS) have at least one or more co- occurring neuropsychiatric disorders, most commonly obsessive-compulsive disorder (OCD) and attention/deficit-hyperactivity disorder (ADHD). There is evidence to suggest an overlapping neural network between these disorders, however, this is yet to be directly tested. We aimed to localize the network of brain regions associated with OCD and ADHD (separately), and then compare their similarities/differences with a network we previously localized in TS (Zouki et al., 2023, Brain Comms.). Separate systematic searches were conducted in Embase and MEDLINE Complete to identify neuroimaging studies reporting coordinates of structural alterations amongst OCD or ADHD patients compared to healthy controls. Following our previous methods, we then applied a network localization technique, termed 'coordinate network mapping' (CNM). This

allowed us to identify neural networks associated with OCD and ADHD, and commonalities between these networks and our TS network. T-tests using functional connectivity maps were conducted to assess the specificity of network regions to each disorder. Our study provides the first application of CNM to coordinates of neuroimaging findings in OCD. Specifically, alterations in OCD mapped to the bilateral caudate, putamen, claustrum, thalamus, and left insula. Neuroimaging findings in ADHD localized to the bilateral precentral gyrus, mid-/anterior cingulate, corpus callosum, thalamus, putamen, insula, showing some consistency with previously reported CNM findings in ADHD (Wall et al., 2025). When visually comparing the networks for all disorders, similarity was shown primarily in the putamen, which could be related to shared deficits in inhibition or executive function.

Examining the role of brain excitation-inhibition in social processes using functional magnetic resonance spectroscopy (fMRS)

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An imbalance in brain excitation-inhibition (E-I) has been implicated in autism and social communication difficulties. Recent advances in functional magnetic resonance spectroscopy (fMRS) now allow non-invasive measurement of dynamic changes in E-I-related neurometabolites (glutamate and GABA), revealing potential links with cognitive processes. This study used functional MRS (fMRS) to investigate whether brain E-I is modulated by socially laden stimuli and whether modulation relates to Research Domain Criteria (RDoC) Social Processes.

Forty neurotypical adults (18–40 years; 20 female) underwent 3T MRI. fMRS data were acquired using HERMES, measuring GABA+ in the right temporoparietal junction (TPJ; social brain) and visual cortex (V1; control). Participants viewed a fixation cross (rest; 5min) as well as silent video clips of social interaction and a flashing checkerboard as control stimulus (5min each; counterbalanced). The Social Responsiveness Scale (SRS) assessed RDoC Social Processes.

Trends emerged for decreased GABA+ and increased glutamate+glutamine (Glx) in response to dynamic stimuli, although differences across stimuli were not significant (ps>.05). Bayesian analyses showed a −.725 decrease in TPJ GABA+ for checkerboard vs. cross (95%CrI: [−1.157, −.276]), and a .523 increase in V1 Glx (95%CrI: [.191, .888]). Higher SRS scores correlated with resting TPJ Glx (r=.325, p=.040, BF=1.13), but not GABA+. Dynamic metabolite concentrations were not associated with SRS scores (ps>.1). Novel sliding time window analyses and equivalent fMRI data will be presented.

This was the first study to examine dynamic E-I responses to social stimuli. While modest, results demonstrate feasibility into the application of fMRS in cognitive neuroscience.

Characterising excitation and inhibition with TMS-evoked EEG potentials from prefrontal and parietal cortex: a pharmacological study with carbamazepine and diazepam

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Measuring the brain's response to transcranial magnetic stimulation (TMS) with electroencephalography (EEG) has been invaluable for understanding the physiology of different neural circuits, particularly following stimulation of the primary motor cortex (M1). However, the mechanisms underpinning TMS-evoked EEG potentials (TEPs) following stimulation of areas outside M1, such as the prefrontal cortex (PFC) and parietal cortex (PAR), remain unclear. Here, we provide preliminary evidence for pharmacologically- induced changes in PFC and PAR TEPs of seven young healthy participants (mean ± standard deviation, range; 31.3 ± 9.4 years, 22 – 47 years.). Participants attended three experimental sessions in which TEPs were recorded before and two hours after the administration of diazepam (10 mg, positive allosteric modulator of gamma-aminobutyric acid type-A receptor; GABAAR), carbamazepine (200 mg, voltage-gated sodium channel blocker; VGSC), or placebo in a pseudo-randomised, double-blind, cross-over design. Changes in TEPs were assessed using Bayesian t-tests (Bayes Factor, BF). We found an increase in negative PFC TEP peaks at 40 (N40; BF = 4.73) and 100 ms (N100; BF = 6.53) following intake of diazepam, whereas there was an increase in the positive PFC TEP peak at 20 ms (P20; BF = 5.63) following intake of carbamazepine. In contrast, there was insufficient evidence for changes within PAR TEPs (BF < 1.48). These preliminary findings suggest that N40 and N100 TEPs are sensitive to GABAAR-mediated neurotransmission, whereas P20 is sensitive to VGSC-mediated excitability. Additional data are required to clarify the drug effects on PAR TEPs.

Global vs. local feature processing in early visual stages: evidence from N1 and vMMN

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A longstanding debate in vision science centers on whether the human visual system prioritises global configurations over local features during early perceptual processing. This study employed electroencephalography (EEG) to investigate this question by examining the temporal dynamics of neural responses to Kanizsa figures that differed in either global or local visual properties. Drawing on Gestalt theory and predictive coding, we used an oddball paradigm to isolate early neural responses to deviant stimuli. Standard stimuli consisted of round "pacman" elements ("inducers") that did not form an illusory triangle, whereas deviant stimuli elicited a global triangle percept using either the same round inducers (global change without local change), or round and square discrepant inducers (global and local change). Results showed that global stimuli elicited significantly larger visual mismatch negativity (vMMN) amplitudes with consistent than discrepant inducers, with no significant differences in latency. Moreover, even though both consistent and discrepant inducers produced similar illusory shapes, they evoked distinct N1 components, suggesting differential neural processing. Specifically, consistent inducers were associated with larger N1 amplitudes than discrepant ones. These findings indicate that the visual system preferentially encodes global configurations during early stages of perceptual prediction, even when task-irrelevant. The enhanced N1 response to globally coherent stimuli may reflect the brain's sensitivity to perceptual organisation and its role in facilitating rapid categorisation. Together, the results support theoretical accounts proposing that global information plays a dominant role in early visual processing, aligning with the principles of Gestalt perception and predictive coding frameworks.

Examining the neural and experiential basis of Tourette syndrome: A protocol

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The hallmark features of Tourette syndrome (TS) are motor/vocal tics. However, evidence suggests that the premonitory urge (PU) preceding tics may play a more fundamental role in symptom expression and maintenance. ~90% of individuals with TS report these often distressing subjective sensory, cognitive, and affective experiences. Nonetheless, its neural basis and experiential characteristics remain elusive, and existing measures capture only sensory-focused aspects of this subjective symptom. We present a protocol for the study titled 'Urge-to-tic: Examining the neural and experiential bases of Tourette syndrome' (U- TIC TS), an NHMRC funded project (2025-2027) examining PU in an Australian community- based sample of children with TS using a multimodal (neuroimaging/lived experience/genetics) interdisciplinary framework. Functional MRI, combined with real-time PU monitoring and phenomenological interviews, captures dynamic brain-experience relationships during tic suppression. A blink suppression task tests the generalisability of these mechanisms to natural urges. Finally, the study examines how behavioural intervention for tics modulates both the felt intensity and neural expression of PU. Our pilot structural analysis showed a strong trend relationship between lower left and right insula volume and PU severity in TS patients (n=9) after controlling for total intracranial volume (r= -.70 and .-77 respectively). By integrating structure, function, behaviour, and experience, U-TIC TS advances a more complete model of PU in TS. Its findings aim to clarify mechanisms, guide intervention, and extend current understanding of TS beyond its observable symptoms.

Identifying and predicting trajectories of the sense of coherence in the perinatal period

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Sense of Coherence (SoC) is the key construct in the theory of salutogenesis, or the study of the origins of (mental) wellbeing (as opposed to pathogenesis: origin of disease). In the perinatal context, high SoC has been shown to predict lower pregnancy-specific distress, fewer delivery complications, and increased birth satisfaction. However, less is known about how SoC typically changes over pregnancy, birth, and postnatally and the risk factors and protective factors contributing to SoC trajectory during the perinatal period. Here, we describe and predict common trajectories of SoC in the perinatal period. 680 women in the Mercy Pregnancy and Emotional Wellbeing Study completed four questionnaires during pregnancy and the postpartum capturing SoC, history of childhood trauma, expectations and outcomes from birth and the postpartum, and postpartum social support. Growth mixture modelling was used to classify participants into trajectories of SoC, and multinomial logistic regression models predicted class membership based on the other variables. Four trajectories were identified: 1) High (67%), 2) Low (21%), 3) Rising (8%), 4) Falling (3%). The strongest predictors of class were depression diagnosis, associated with Low and Rising trajectories, and a history of childhood trauma, associated with Low and Falling trajectories. Childhood trauma was thus predictive of a poor

SoC at 12mths postpartum, suggesting that pregnancy and birth have a negative impact on women's resilience resources, whereas depression in early pregnancy is more predictive of poorer starting point of SoC. Targeted mental health support in the perinatal period may ensure individuals have adequate coping resources.

Genetic and Network-Based Constraints on Gray Matter Volume Changes in Psychosis

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Differences in regional grey matter volumes (GMV) are a common finding in MRI studies of psychotic illness, however, the mechanisms shaping their spatial patterning remain unclear. Recent work suggests that GMV changes progress along brain networks with reductions spreading through white matter tracts. Here, we extend existing models by incorporating interactions between brain networks and genetic risk factors. Specifically, we apply an agent-based spreading model to simulate the movement of pathological gene products along the connectome and predict resulting GMV changes.

GMV changes were assessed using voxel-based morphometry analyses on MRI data from 12 independent datasets (1391 healthy controls and 940 patients). Structural connectivity was derived from diffusion MRI data, producing a group-averaged connectome with 35% binary density. Gene expression profiles across the whole brain were provided by the Allen Human Brain Atlas. Our disease model employed an agent-based Susceptible-Infected-Removed (SIR) model, simulating disease progression based on gene expression within regions and connectivity between regions.

Simulated pathological processes and subsequent atrophy were tested across all combinations of potential risk and clearance genes. The resulting atrophy maps were compared with empirical data to determine peak correlations, reaching a maximum correlation of $r=0.58$ (Fig 1a, b, c). Simulated atrophy from gene pairs with high model fit significantly outperformed null models, with $p<0.001$ for both spatial and connectome-rewired null comparisons (Fig 1d, e).

Our results indicate that disease processes, constrained by genomic expression, accumulate locally and propagate along the connectome to shape the distribution of GMV changes in psychosis.

Developing the Lifetime Engagement in the Activities of Parenthood (LEAP) Scale: Capturing Environmental Complexity in Caregiving Across the Lifespan

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Background: Parenthood contributes to lasting changes in brain structure, function, and cognition, with emerging evidence suggesting a neuroprotective effect against cognitive ageing. Long-term environmental complexity is a recognised contributor to cognitive reserve. Our group recently proposed that the enduring cognitive demands of parenthood represent a unique form of such complexity (Orchard et al., 2023). However, the

absence of validated measures capturing these environmental demands limits our ability to examine their impact on the parental brain. Objective: This qualitative phase of a mixed methods study examines how parents conceptualise the cognitive demands of caregiving across the lifespan. Findings will inform item development for the Lifetime Engagement in the Activities of Parenthood (LEAP) scale. Methods: Twenty-nine parents (21 mothers, 8 fathers) participated in one of five focus groups exploring the mental load of parenthood. Participants discussed the nature of these cognitive demands, unique challenges, and suggestions for measurement. Data are being analysed using reflexive thematic analysis within a critical realist framework. Results: Interim analysis points to themes reflecting enduring and evolving cognitive demands (e.g., planning, anticipating, delegating), emotional labour (e.g., caregiving, guiding, teaching), and identity development (e.g., resilience, learning, flexibility) beginning in the peripartum period and extending into late life. Discussion: Preliminary findings suggest that the cognitive demands of caregiving are cumulative, adaptive, and persist across the lifespan. These results provide a foundation for operationalising lifelong parental engagement as a form of environmental complexity and understanding its role in normative ageing trajectories.

Can functional coupling predict outcomes following a first episode of psychosis?

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Background Clinical outcomes following a first episode of psychosis are highly heterogeneous between patients. The identification of prognostic biomarkers would greatly facilitate personalized treatments. Psychosis patients often display brain-wide disruptions of inter-regional functional coupling (FC), with some being linked to symptom severity and remission. FC may thus hold prognostic potential for people experiencing psychosis.

Methods Fifty-five antipsychotic-naïve first-episode psychosis patients (51% female, 15-25 years) were randomized to receive either antipsychotic or placebo tablets for 6 months alongside psychosocial interventions. Functional magnetic resonance imaging was conducted at baseline and after 3 months to evaluate whether baseline FC, or 3-month change in FC, could predict 6- and 12-month changes in symptoms and functioning, quantified using the Brief Psychiatric Rating Scale and the Social and Occupational Functioning Assessment Scale, respectively. We considered three different cross-validated prediction algorithms: (i) connectome-based predictive modelling; (ii) kernel ridge regression; and (iii) multilayer meta-matching. Each prediction model comprised 35 to 49 individuals.

Results All models showed poor performance in predicting patients' 6- and 12-month changes in symptoms and functioning (all mean $r < 0.3$), and no model achieved significance via permutation testing (all $p > 0.05$).

Conclusions Our findings suggest that brain-wide measures of FC may not be suitable for predicting extended clinical outcomes over a 6- to 12-month period in first-episode psychosis patients.

From spikes to symptoms: Simulating SC driven multisensory deficits in ASD

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Individuals with autism spectrum disorder (ASD) frequently exhibit altered multisensory integration, particularly enlarged temporal binding windows that impair speech perception and social communication. While various synaptic and cellular alterations have been implicated in ASD, the causal pathways linking these circuit-level perturbations to specific behavioural phenotypes remain elusive. To address this gap, we developed a biologically plausible spiking neural network of the superior colliculus (SC), a key subcortical hub for audiovisual binding, incorporating realistic alpha-amino-3-hydroxy-5-methyl-4-isoxazolepropionic acid (AMPA) and N-methyl-D-aspartate (NMDA) receptor kinetics, gamma-aminobutyric acid (GABA)-mediated inhibition, and spike-timing-dependent plasticity (STDP). Through systematic parameter manipulation, we discovered that distinct neural alterations produce characteristic integration deficits: reduced neuronal adaptation uniformly expanded both spatial and temporal binding windows through sustained depolarization, whereas diminished feedforward inhibition paradoxically contracted spatial windows while expanding temporal ones, indicating distinct roles for early inhibitory gating in space and time. Furthermore, NMDA

conductance alterations bidirectionally modulated these windows, with hyperfunction generating permissive fusion and hypofunction curtailing integration. Each perturbation uniquely affected localization precision and multisensory benefit. Together, these results show how heterogeneous synaptic and cellular changes can converge on similar multisensory symptoms while leaving unique computational fingerprints. The framework yields testable predictions - linking, for example, restoration of adaptation or targeted augmentation of inhibitory control to normalisation of binding - and suggests mechanism-specific avenues for intervention. By mapping synaptic alterations to measurable perceptual outcomes in a biologically grounded circuit, our work clarifies potential sources of phenotypic variability in autism and outlines principled targets for future experimental and translational work.

Structure-metabolism coupling in healthy aging: a multimodal brain network analysis

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Understanding how the human brain's physical structure gives rise to dynamic brain activity is fundamental, as this relationship underpins cognitive performance, ageing, and various psychiatric and neurodegenerative disorders. Previous studies suggest that brain activity measured by functional magnetic resonance imaging (fMRI) is shaped by underlying white matter structure. Compared to fMRI, the recently developed functional [18F]- fluorodeoxyglucose positron emission tomography (fPET) offers a more direct and quantitative index of dynamic brain activity via glucose metabolism. However, it remains unknown to what extent metabolic activity is constrained by the brain structure. This study aimed to investigate the structure-metabolism relationship using simultaneous PET-MR in a cross-sectional sample of 85 healthy adults, divided into two age groups (40 younger adults: mean age 27.9 years, range 20-42; 45 older adults: mean age 75.7 years, range 66-89). Diffusion MRI and resting-state fPET data were preprocessed using standard pipelines, and brain regions were defined using the Schaefer 100-node whole-brain atlas. Preliminary analysis revealed a significantly positive correlation between structural and metabolic connectivity across participants (Spearman $_2$ = 0.34, $p < .001$). Furthermore, structural- metabolic connectivity coupling is significantly weaker in the older group compared to the younger group ($t = 3.11$, $p = .0025$). These findings provide initial evidence that metabolic activity is constrained by the white matter structure, and that the structure-metabolism coupling diminishes with age. Ongoing work will extend these findings to examine more detailed spatial and network-level patterns.

Funding: Sharna Jamadar is supported by an Australian National Health and Medical Research Council (NHMRC) Fellowship (APP1174164)

COA-Cl restores dopamine loss in the striatum of the MPTP- induced Parkinson's disease mouse model

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COA-Cl, a novel adenosine-like nucleic acid analog, has recently been shown to increase dopamine (DA) levels and exert neuroprotective effects both in vivo and in vitro. Based on these findings, we hypothesized that COA-Cl could reverse the loss of DA caused by 1- methyl-4-phenyl-1,2,3,6-tetrahydropyridine (MPTP), a toxin known to induce Parkinson's disease (PD) in humans.

To test this hypothesis, we utilized MPTP-induced mouse models of PD. Mice were perfused with Ringer solution (control) or COA-Cl (0.025, 0.05, 0.1, or 0.2 mM in Ringer solution). Striatal dialysates were collected every 5 min in freely moving mice, and DA levels were analyzed using in vivo reverse microdialysis with the aid of HPLC-ECD. Tyrosine hydroxylase (TH) phosphorylation at Ser31 (pSer31) and TH protein l

quantified by Western blot.

Our results showed for the first time that COA-Cl at concentrations of 0.05, 0.1, or 0.2 mM dose-dependently restored extracellular DA loss caused by MPTP, accompanied by an increase in TH at Ser31, indicating potential restorative effects on striatal DA depletion in the MPTP model. These findings suggest that COA-Cl may hold promise as a therapeutic candidate for the treatment of neurological dysfunction associated with low levels of DA. Further studies are currently underway to explore the potential synergistic effects of combining COA-Cl with ethanol in restoring DA function in PD models.

Funding: This work was supported by a Grant-in-Aid for Scientific Research [Grant No. (c) 23K09766] from the Ministry of Education, Culture, Sports, Science, and Technology, Japan.

A geometric resonance model of the mammalian connectome

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Understanding the organizational principles that shape the network architecture remains a fundamental challenge in neuroscience. The prevailing view is that the brain is a discrete network of intricately connected neurons and neuronal populations (Bullmore & Sporns,

2009). From this framework, several generative network models have been proposed to identify the wiring rules that shape connectome architecture (Betzel, 2017). These models are generally able to capture topological properties of empirical data, but fail to capture topographical (i.e., spatial) properties (Oldham 2022; Arnatkeviciute, 2021).

An alternative view, informed by neural field theory (NFT) (Robinson et al., 1997), involves treating brain structures, particularly the cortex, as continuous. Spatiotemporally patterned neocortical dynamics are then viewed as emerging from waves of excitation travelling through the continuous cortical sheet (Robinson et al., 1997). Critically, it can be shown that these waves arise from a superposition of a fundamental basis set of elemental, resonant standing wave patterns that correspond to the eigenmodes of cortical geometry, an equivalence given by the well-known Helmholtz equation used in diverse diverse areas of physics and engineering (Robinson, 2016 ;Pang, 2023).

A corollary of this view is that anatomical connections in the brain may preferentially link different areas to support resonant dynamics, under a Hebbian-like plasticity mechanism. Here, we test this hypothesis by using a simple model that preferentially connects distinct cortical areas according to their profiles of geometric resonance. We show that the model captures key features of connectome topography across species and imaging modalities.

Hippocampal Projections Predict Anxiety During Threat Extinction in Adolescents

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Identifying threat is critical for survival, yet threat overestimations can prevent individuals from accomplishing other goals, such as exploring and learning. A delicate balance between threat and safety can be difficult to achieve, particularly during adolescence. Adolescence represents a sensitive period when threat-related perturbations emerge and neural circuits are most malleable, making it important to understand how the brain processes threat and safety stimuli in youth at risk for anxiety disorders. In the present study, 87 adolescents (ages 11-17, M=15.66, SD=.94) completed a fear conditioning and extinction paradigm using emotional faces and an unconditioned scream stimulus. We used dynamic causal modelling (DCM) to interrogate functioning of the amygdala, posterior ventromedial prefrontal cortex (pVMPFC), and hippocampus to CS+ (conditioned threat) and CS- (safety) during early conditioning and early extinction. DCM is a Bayesian analysis approach that infers the directed

(causal) influences between brain regions. Results revealed distinct patterns of modulatory connections across different phases (early conditioning/early extinction) and stimulus types (CS+/CS-). Early conditioning circuits were reversed for early extinction, switching from excitation of the amygdala by the hippocampus to inhibition of the hippocampus by the amygdala. Bidirectional excitatory amygdala-pVMPFC inputs also became inhibitory. Four specific modulatory connections predicted individual differences in trait anxiety (pp>0.95). Most notably, during CS+ extinction, the hippocampus retained excitatory projections to the amygdala and excited the pVMPFC for those higher in trait anxiety. Our findings identify neural biomarkers for anxiety vulnerability and provide mechanistic insights into neural network dynamics of adolescent threat and safety learning.

Do I experience happiness in the same way as you do? A relational approach to characterize emotional experience

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Do people experience emotions in the same way? How can we characterize the sameness of emotional quality? Qualitative aspects of emotional experience are typically communicated through verbal reports (e.g., "I am happy"). However, words can be ambiguous or carry different meanings across individuals, and some feelings are difficult to verbalize or have limited accessibility for certain people. As a result, people may describe the same feeling in different ways. To ameliorate this situation, we propose studying the subjective experience of emotion with a relational approach, which is gaining momentum in consciousness research. Here, we propose a relational approach to characterize emotional experiences through massive pairwise similarity judgments among emotional experiences evoked by short videos. Characterizing emotional experience through this structural approach, we address a long-standing puzzle in emotion research: emotional experience in alexithymia. It remains unclear whether individuals with alexithymia (e.g., "no words for emotions") experience emotions normally but struggle to name them, or whether they experience emotions differently or even not at all. Our online pilot results (N = 769) suggest that people who score high on alexithymia in the general population are likely to have the same quality of emotional experience, yet do so less reliably. We will use stimuli different from the pilot and recruit a fresh set of participants for the stage 2 registered report. Our study will open new avenues for studying subjective emotional experience by providing a relational approach that bypasses verbal reports and will help clarify the nature of alexithymia.

Brain associations of affinity scores across the psychosis continuum

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Psychotic disorders exist along a continuum of symptoms and cognitive impairments with high individual variability, making it difficult to link brain structure with clinical features. To address this, we applied Affinity Scores, an individual-centric framework that quantifies a person's similarity to different psychosis subgroups based on cognitive and clinical data.

We analyzed data from 671 participants aged 18-60, including healthy controls, individuals at ultra-high risk, first episode psychosis, and schizophrenia. Clinical assessments included global functioning (SOFAS); UHR symptoms (CAARMS), and psychotic symptom severity (PANSS).

Cognitive functioning was assessed using WAIS-III for estimating IQ; BACS for verbal memory and working memory, fluency, and processing speed; and CANTAB for spatial working memory, planning, cognitive flexibility, reaction time, and sustained attention.

T1-weighted brain scans were conducted on a subset using a Philips 3T whole-body MRI scanner. Images were segmented in FreeSurfer using Desikan-Killiany atlas to estimate regional brain volumes.

For each participant and variable, affinity scores to each diagnostic group were computed by analyzing standardized distances within the population. We used linear regression to identify associations between regional brain volumes and affinity scores.

We found significant associations between brain volumes and affinity scores across the psychosis continuum. Frontal, temporal, and parietal regions were linked with affinity to healthy controls, while orbitofrontal, fusiform, lingual, and paracentral regions were associated with higher affinity to clinical groups.

These findings suggest that Affinity Scores reflect individualized brain-behavior relationships and may serve as a neurobiological marker in psychotic disorders.

Dopaminergic and Cholinergic Alterations in the Hippocampus and Prefrontal Cortex of MPTP-Treated Marmosets: An Immunohistochemical Study

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Motor symptoms traditionally characterise Parkinson's disease (PD), but cognitive dysfunctions have recently emerged as significant non-motor features. While dopamine deficiency in the substantia nigra primarily causes PD, recent evidence indicates disruptions in neurochemical pathways beyond the nigrostriatal system also contribute to cognitive dysfunction. This preclinical study examines the roles of dopamine and acetylcholine within the hippocampus and prefrontal cortex (PFC), assessing how their combined reduction manifests as neurochemical alterations in brain regions relevant to cognitive function in PD. Ten adult marmosets were used; five were treated with 1-methyl-4-phenyl-1,2,3,6- tetrahydropyridine (MPTP) to model Parkinsonian pathology, and five served as healthy controls. Immunohistochemistry quantified critical changes using ImageJ software. Results indicated MPTP significantly reduced neuron count, fibre length, and optical density (OD) in both regions. Specifically, tyrosine hydroxylase (TH)-positive neurons decreased by 66.2% in the hippocampus and 48.7% in the PFC, while Choline Acetyltransferase (ChAT)-positive neurons decreased by 47.6% and 39.5%, respectively. Fibre length and OD similarly decreased by more than 55% in both regions. These uniform neurochemical alterations provide insights into the multifactorial neurochemical pathology observed in brain regions associated with cognitive dysfunction in PD. Although behavioural assessments were not conducted, the observed histopathological alterations in this model correspond with established neural substrates implicated in PD-related cognitive dysfunction. These findings underscore the need for targeted therapeutic strategies that address the complex, multi- neurotransmitter basis of the neurochemical pathology associated with cognitive dysfunction in PD.

Is affective valence really only about uncertainty reduction? How meditative experience challenges prevailing computational accounts of affect

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Prevailing computational accounts of affective valence link valence to an agent's subjective evaluation of its allostatic success in staying alive, with active inference accounts exemplifying this view. While this is an intuitive and promising approach, how valence is modulated in meditative experience poses a challenge to such a view. I examine the overlap and tensions between the uncertainty-reduction view and the meditative understanding of valence, arguing that the phenomenology of valence from meditative experience is insufficiently explained by uncertainty-reducing accounts rooted in survival. I take an interdisciplinary approach that combines phenomenological analysis of meditative experience, conceptual analysis of computational theories of affective valence, and a theoretical synthesis of Buddhist psychology and computational neuroscience. I show that the degree of negatively valenced contraction from clinging (attachment to phenomena) maps onto increased higher-level processing and

complexity in an agent's model of reality. Crucially, reducing this higher-level engagement improves valence even in cases where uncertainty increases. I distinguish between clinging-dependent and clinging-independent influences on valence, showing how both short-term meditative deconstruction and long- term meditative development can alter their influence. Drawing on this, I advance a 'dual- determinant' theory of valence, where uncertainty reduction and hierarchical depth co- determine experienced valence. This meditation-informed re-examination of affective valence permits a more comprehensive account of its computational role within active inference, which has important consequences for how we seek to reduce suffering and increase well-being.

Exploring blood-based biological correlates of cognitive intra- individual variability and other cognitive measures in bipolar disorder

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Cognitive impairment is a common and functionally meaningful characteristic of bipolar disorder (BD), but its biological underpinnings are yet to be fully established. Emerging evidence posits telomere length and peripheral inflammation as prospective factors of interest. In this study, we examined the independent and synergistic associations between these biological factors and cognition in BD. One hundred and forty-nine participants (n=92 people with BD and n=57 healthy controls) completed cognitive assessments of processing speed, sustained attention, working memory, executive function, and neurocognitive intraindividual variability. Whole-blood and plasma was also provided by subsamples within this, from which genomic DNA was extracted to measure telomere length, and several inflammatory cytokines and chemokines were examined within composite scores. Multivariate regression analyses explored associations of these variables. Poorer cognition, higher intraindividual variability, and shorter telomeres were found in the BD group compared to healthy controls. No significant group differences in either of the inflammatory composites were identified, and no independent associations of cognition with telomere length or either inflammatory composite were observed. However, a synergistic interaction of the biological variables was evident in the BD group, whereby BD patients with a combination of shorter telomeres and high levels of inflammatory cytokines and chemokines demonstrated poorer processing speed. All in all, the relationship between cognition and blood-based biological markers in BD is complex. This work provides preliminary evidence that poor processing speed in BD is influenced by the combined, rather than the isolated effects, of telomere length and inflammation.

Environmental Context Modulates Neural and Affective Responses to Meditative Chanting

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Meditation is increasingly integrated into mental health interventions, yet how specific techniques interact with environmental context remains unclear. This study investigated

how rhythmic vocal meditation (Om chanting) influences neural activity and emotional states, and whether effects are enhanced when practiced in natural outdoor environments.

A within-subjects design invited healthy adults (n = 110) to chant Om and recite the alphabet (matched vocal control) for 10 minutes in both indoor and outdoor settings. Om chanting was selected due to its widespread use in contemplative traditions, and the alphabet control was chosen to match the respiratory and vocal demands of chanting without the meditative or spiritual associations. Self-reported mood (valence and arousal), feelings of connection to nature, and EEG alpha (relaxed attention) and theta (deep meditative state) power were measured.

Om chanting improved positive mood, reduced arousal, and increased connection to nature compared to the vocal control across both environments, with stronger effects observed outdoors (valence: d = 0.33 indoor, d = 0.42 outdoor; arousal: d = 0.33 indoor, d = 0.36 outdoor; nature connectedness: d = 0.30 indoor, d = 0.53 outdoor). No differences in EEG activity between vocalising conditions were observed indoors. However, chanting in outdoor environments was associated with increased theta activity (t = 2.408, p = .018, d = 0.25), an effect not observed during the alphabet recitation (t = 0.797, p = .428).

These findings suggest that meditative vocalisation and natural settings may work together to enhance emotional and neural outcomes, supporting the use of nature-based sound meditation interventions.

Phase similarity between similar objects indicates representational merging across retrieval training but not sleep

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Retrieval training is theorised to induce rapid memory consolidation, leading to the same increased similarity between related neural representations as sleep. However, limited comparisons of representational change exist between sleep and retrieval training in the same study or investigating the fast time-scale dynamics of this process. Thirty participants (27F, 18–34) completed four sessions where they learnt object-word pairs, followed by immediate and delayed recognition testing across one of four 120-minute interventions (retrieval training, restudy, sleep, or wake). We compared inter-item EEG phase similarity between similar and different objects to assess changes in representational similarity pre- intervention, and across the four interventions. We predicted that EEG phase similarity for similar objects would increase (representational merging) across retrieval training and sleep interventions. We further expected that greater representational merging would lead to a greater endorsement of similar-object lures. Cluster-based permutation testing revealed that representational merging occurred pre-intervention between 4–9Hz, 140–700ms post- object onset (p=.021). Another cluster-based permutation revealed that representational changes in a 13–30Hz, 380–700ms cluster (p=.038) differed across the four conditions' interventions. Crucially, further modelling demonstrated that only the retrieval training condition elicited additional representational merging in 400–700ms alpha-band activity, chi2(4)=24.94, p<.001. Surprisingly, this representational merging led to better discrimination of similar-object lures during delayed recognition (chi2(3)=4.78, p=.029, OR=1.04, 95%CI [0.01,0.06]). These findings reveal differences between sleep-based and retrieval-mediated memory consolidation, and that representational merging may allow for better side-by-side comparisons between similar memories in tasks where both memories must be maintained.

Intersubjective agreement reduces friction between report and visual experience

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In consciousness research, a major methodological challenge is that we can only observe participants' objective behaviors and infer their subjective experience. To reduce the friction, Chuyin et al. (2022) introduced a novel free-report paradigm where participants freely reported five words to describe a briefly presented (67–267 ms, masked) natural scene. They developed an index, intersubjective agreement, to quantify the specificity of each response word. In the current study, we further analyze these freely reported words and expand on the measurement of conscious experience. A key argument is that participants' reports should not be constrained by experimenters' expectations of the experience, which is a fundamental issue in consciousness research. Rather than focusing on the (researchers' expected) veridicality of experiences, we argue that the emphasis should be on the "what-it-is-like" to be a participant. We also discuss controversial concepts such as gist and richness, and highlight the significance of the specificity of reported words, quantified by intersubjective agreement. In this context, we refer to the recent replication attempt by Hirschhorn and Mudrik (2024). Despite the differences in key methodologies, their results reinforced the reliability of the intersubjective agreement index. By combining data from both studies, we demonstrate that a set of five response words adequately specifies the presented image, suggesting that freely descriptive words reflect participants' experience. Taking them together, we advocate that researchers should not fixate on behavioral reports, but be mindful of the subjectivity of conscious experience in their study design, data analysis, and interpretation.

Measuring the Diversity of Qualia: A Category-Theoretic Approach to Psychophysical Experimental Data

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Quantifying the qualitative aspects of subjective experience remains a challenging open problem. The recent Qualia structure approach proposes to characterize qualia through massive relations with other qualia. One way to do so is to use pairwise similarities. This approach has been successfully applied to reveal similarities and differences in qualia structures between groups of humans (e.g., color typical vs atypical). Still, the method for analyzing and interpreting this structure is under exploration. Here, we introduce several measures of "diversity" based on the category-theoretic formulation of similarity relationships among qualia. These measures are principled mathematical formulations for the concept of "size" of an abstract structure, which we believe as promising indices for assessing experiential richness.

We evaluated two approximations of "diversity" — "generalized magnitude" and "spread" — using dissimilarity matrices derived from multiple psychophysical experiments. Participants rated the pairwise similarities among color and emotion terms, emotion-inducing videos, or color patches; these ratings were then transformed into dissimilarities and analyzed using each index. We compared how each metric behaved at both the group and individual levels.

Even when empirical similarity data violate metric axioms, category-theoretic diversity indices can be computed; they may be useful to conceptualize and define the controversial philosophical/psychological idea of "richness" of qualia in a quantitative way.

Cultivating scientific humility: A brief metacognitive intervention to combat my-side bias and misinformation susceptibility

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Misinformation driven by cognitive biases like motivated reasoning and myside bias, has eroded trust in experts. Existing evidence-based strategies emphasise widespread critical thinking education; however, implementing such solutions has proven impractical. To address this, we developed a focused, quick, yet memorable brief metacognitive intervention video titled "Could I Be Wrong?" This intervention provided metacognitive instruction on two key elements of critical thinking—scientific humility and evaluating counterarguments. Participants (N = 182; mean age = 31.2 years; 41% female) were randomly assigned to an intervention or control group. Those receiving the intervention showed significantly less my-side bias and susceptibility to misinformation compared to controls.

Notably, the intervention effects were strongest for individuals with high initial metacognitive awareness. These findings suggest that focused, quick, and memorable evidence-based interventions can enhance critical thinking and help counter misinformation, while offering a scalable strategy for use in education, media literacy, and other public health initiatives.

Narcissism Is associated with blunted error-related brain activity

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Narcissism is associated with self-enhancement and social antagonism, yet its neural underpinnings, particularly in error processing, remain underexplored. Competing theoretical models, such as the mask model and the metacognitive model, offer conflicting hypotheses regarding how narcissism influences early neural responses to errors. We examine whether grandiose agentic narcissism relates to an elevated or blunted error- related negativity, a neural marker of cognitive control and performance monitoring. In Study 1 (N = 144), participants completed the Eriksen Flanker Task while we recorded their neural responses to errors using electroencephalography. In Study 2 (N = 50), participants completed a modified version of the Flanker Task that included explicit trial-by-trial feedback. Participants then completed the Narcissistic Admiration and Rivalry Questionnaire to assess admiration and rivalry narcissism. Higher admiration and rivalry narcissism were associated with a blunted (less negative) error-related negativity. These associations held when controlling for the number of errors and were confirmed by an internal meta-analysis, which showed moderate effect sizes across analytic approaches. The results are consistent with the metacognitive model of narcissism, showing that grandiose narcissists exhibit reduced neural sensitivity to errors. These findings highlight a potential mechanism through which narcissists resist self-corrective learning, bolstering their positive self-views. Bunted error processing may influence decision-making and behavior across contexts.

Positive arousal links positive urgency and choice impulsivity

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Generally, there is little correlation between trait- and state-level impulsivity. Arousal – that is, heightened positive or negative emotion – may be the missing link between trait and state impulsivity. People with high trait impulsivity – assessed via self-report urgency surveys – may only exhibit heightened cognitive state impulsivity – captured via behavioural tasks – when sufficiently aroused.

Participants (n=155, MeanAge=20.95 years) completed baseline assessments of subjective mood, self-reported positive urgency, choice impulsivity, and working memory. They were categorised as having High (n=53), Medium (n=49), or Low (n=53) positive urgency. Following positive mood induction, participants repeated assessments of subjective mood, choice impulsivity, and working memory. Differences in choice impulsivity and working memory across conditions were explored as a function of positive urgency group.

With choice impulsivity, repeated measures ANOVA showed a significant main effect of condition (p=.037, partial eta squared=0.03), positive urgency group (p=.048, partial eta squared=0.04), and an interaction between condition and

group (p=.042, partial eta squared=0.04). Interactions did not survive post hoc comparisons though, in the case of High (but not Medium or Low) positive urgency individuals, choice impulsivity was greater in the Positive condition relative to Baseline (p=.066, Cohen's d=0.21). There were no differences in working memory.

When positively aroused, individuals with high positive trait impulsivity show heightened choice impulsivity. Future work will examine links between high negative trait impulsivity and choice impulsivity and extend to other cognitive measures of impulsivity.

Age-dependent effects of multilingual experience on executive and metacognitive functioning: Evidence from Generalised Additive Modelling

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Multilingualism has been proposed as a potential factor that modulates cognitive domains such as memory and executive function across the lifespan. However, evidence for these effects remains mixed, partly due to limited sensitivity of measures and statistical models. This study used Generalised Additive Models (GAMs) to examine the influence of age and multilingual experience, operationalised via the Language History Questionnaire (LHQ-3) Multilingual Language Diversity Score (MLDS), on cognitive self-report outcomes. Eighty-six participants aged 18-80 completed the LHQ-3 and both the Dysexecutive Questionnaire (DEX) and Multifactorial Memory Questionnaire (MMQ). GAMs were fitted to predict six outcome domains: Behavioural-Emotional, Metacognition, Executive Cognition (DEX), and Satisfaction/Feelings, Ability/Mistakes, and Strategy (MMQ), controlling for education. Language diversity was significantly associated with improved DEX Behavioural-Emotional (p = .015) and Executive Cognition scores (p = .009). Age consistently predicted outcomes (p<.05). Importantly, MLDS × Age interactions were significant across Metacognition, Executive Cognition, Ability/Mistakes, and Strategy (p<.05), indicating that the effects of being multilingual vary non-linearly across the lifespan. Interaction surface models revealed age-dependent inflection points where multilingual experience had either protective or neutral effects on cognitive functioning, with increased age. These findings suggest that multilingual experience is not uniformly beneficial but interacts with age in complex, domain-specific ways. By modelling non-linear interactions, this study provides new evidence supporting the dynamic role of multilingualism in shaping subjective cognition across adulthood. These results have implications for understanding individual variability in cognitive ageing and highlight the importance of appropriate modelling for experience- based factors in cognitive neuroscience.

The Relevance of Oxygen for Decision Making

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We study the causal effect of hypoxia, when oxygen is not available in sufficient amounts, on decision making and cognition in a blinded, laboratory experiment. While we know its effects on health, it is unclear how hypoxia influences our choices, e.g., cognitive control. This is a pressing issue since experiencing hypoxia is becoming more common due to climate change (e.g., bush-fires and air pollution) and for medical reasons (e.g., asthma).

We observe a systematic effect of hypoxia across a wide array of tasks, from perceptual (e.g., colour perception), to cognitive (e.g., Stroop, Simon, Go/No-Go task), to more complex decisions (e.g., risky choices, altruism, IQ).

Understanding how hypoxia influences cognition gives us a window on how cognition is impaired by a causal manipulation of the available cognitive resources and could inform us on how people decisions might be negatively influenced when we lack some of the crucial resources required to reason.

Distinct Neurocognitive Signatures for Inattention, Hyperactivity-Impulsivity, and Cognitive Disengagement Syndrome: A Meta-Analytic Investigation

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Cognitive Disengagement Syndrome (CDS) has been proposed as a construct overlapping with, but distinct from, ADHD-related inattention and hyperactivity-impulsivity. However, prior meta-analyses have failed to identify unique neurocognitive profiles for these symptom dimensions, possibly due to failure to control for symptom overlap. We conducted a comprehensive meta-analysis of the neurocognitive correlates of inattention, hyperactivity- impulsivity, and CDS. A total of 115 cross-sectional studies were included, encompassing child and adult participants from clinical and community samples. Bivariate random-effects meta-analyses were performed across 19 cognitive domains. To isolate distinct cognitive associations, we conducted multiple regressions on pooled correlation matrices, controlling for symptom overlap. Sensitivity analyses, moderation analyses, and GRADE assessment for certainty of evidence were also conducted. Bivariate analyses showed overlapping neurocognitive weaknesses across CDS, inattention, and hyperactivity-impulsivity. However, multiple regression analyses revealed more distinct patterns. Among the larger effects, inattention was associated with poorer response inhibition, working memory, perceptual- motor functioning, memory, perceptual reasoning, and intelligence (standardised betas = -.21 to -.10, $p < .01$). Hyperactivity-impulsivity was characterised by weaker social cognition, sustained and focussed attention (standardised betas = -.24 to -.11, $p < .001$). CDS was linked to slower processing speed and weaker interference control (standardised betas = -.29 to -.13, $p < .001$). Findings provide evidence for distinct neurocognitive signatures across CDS, inattention, and hyperactivity-impulsivity when controlling for symptom overlap. Our work highlights the need to adopt symptom-specific dimensional analyses to inform clinical assessment and intervention.

Neurotransmitter Concentrations in Anorexia Nervosa

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The neurobiological underpinnings of anorexia nervosa (AN) remain unclear, limiting treatment options. Findings from our recent research identified square wave jerks (SWJ), a type of atypical eye movement, as a promising biomarker/endophenotype for anorexia nervosa. The presence of this type of eye movement suggests differences in gamma-aminobutyric acid (GABA) and glutamate (Glu) concentrations in the superior colliculus in individuals with AN; and the aim of this study was to investigate these differences. Data from 89 female participants, including 22 current anorexia nervosa (c-AN), 22 weight- restored from anorexia nervosa (wr-AN), 22 biological sisters of people with anorexia nervosa (AN-sis), and 23 aged matched healthy controls (HCs), underwent magnetic resonance spectroscopy of the superior colliculus and supramarginal gyrus. Preliminary analyses suggest that although groups did not differ in GABA or Glu in the superior colliculus or supramarginal gyrus, SWJ rate negatively correlated with GABA and positively correlated with Glu in the superior colliculus in c-AN. The preliminary findings suggest that differences in GABA and Glu concentrations in the superior colliculus may relate to the atypical eye movements observed in AN and provide potential support of the neurobiological basis of this biomarker/endophenotype that can be targeted in future treatment trials.

The importance of temporal proximity of trauma cues in exposure therapy for posttraumatic stress disorder: Evidence from fear conditioning

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It is not known how well fear conditioning experiments map onto posttraumatic stress disorder (PTSD) symptomology and treatment, and yet they are the most used experimental paradigms for theoretical literature in PTSD. In these experiments, the 'extinction' phase is analogous to exposure therapy. Based on Ehlers & Clark's (2000) cognitive model, stimulus temporal proximity should create the strongest learning conditions and result in the best target for extinction.

Two experiments were conducted in healthy participants (N=138) using a conditioning paradigm. The extinction efficiency a novel stimulus that was temporally proximal to aversive reinforcement (electric shock) was assessed compared to: (1) a conventional predictive stimulus, and (2) another novel stimulus that had semantic similarity to the shock.

In both experiments, we found that the conditional stimulus presented at the same time as shock significantly strengthened conditioning compared to a conditional stimulus that predicted aversive reinforcement onset. In experiment 2, we further found that the temporally proximal stimulus that was not semantically related to the aversive reinforcement outperformed the stimulus that was semantically similar.

These findings have significant implications for the study of PTSD using fear conditioning and suggest that a shift towards associative pairing with a temporally proximal stimulus is more relevant for PTSD compared to associative pairing with a predictive stimulus. We also found preliminary evidence that targeting memories with semantic similarity to the aversive event may be a less powerful way of conducting therapy compared to stimuli that are temporally proximal, but semantically unrelated, to the aversive event.

Healthy cognitive ageing is associated with reduced decision- making capacity

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Later life often involves critical financial and healthcare decisions, such as how to manage one's income in retirement. With ageing populations and increasingly complex administrative systems, understanding the impact of healthy cognitive ageing on decision- making is crucial. Despite a plethora of research on how ageing affects basic cognition, how this scales up to higher-order decision-making remains under-explored. To address this, we conducted a large (n=357), pre-registered online experiment comparing decision-making capacity (operationalised with the knapsack optimisation task; KOT) and basic cognition (measured with a battery of cognitive tasks) between younger (18-30) and older (65+) adults. Older adults performed significantly worse on the KOT, particularly on easier instances, despite spending more time than their younger counterparts. This deficit was primarily explained by lower performance on the cognitive tasks and not by age, education, health, or motivation. Furthermore, older adults made more 'simple' mistakes, explored the search space less, and were more overconfident. These findings are consistent with healthy cognitive ageing impairing decision-making capacity due to cognitive decline, with important implications for policy and choice architecture design, particularly in ageing populations.

Trajectories of Delay Discounting and Smoking from Adolescence to Young Adulthood

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Robert Hester, Melbourne School of Psychological Sciences, The University of Melbourne

Delay discounting is consistently implicated in nicotine use, with dependent smokers exhibiting greater discounting rates than non-smokers. The temporal relationship of delay discounting and smoking, however, has been relatively understudied. Thus, it remains largely unknown whether delay discounting is predictive of both the initiation of occasional smoking and the transition from occasional use to daily use. Using a large longitudinal dataset from the IMAGEN project (n = 1668), we computed a multistate Markov model to determine whether transitions between smoking states during mid-adolescence to early adulthood can be predicted by delay discounting rates. As a secondary analysis, we applied a latent growth curve model to explore the reciprocal relationship between delay discounting and smoking frequency over time. Results revealed that higher delay discounting predicted a greater likelihood of initiation of occasional use, with a non- significant trend towards increased likelihood of transition to daily smoking. Results of the latent growth model indicated that the trajectory of smoking frequency was predicted by both baseline levels of delay discounting and the trend of delay discounting over time. Smoking, however, was not found to predict changes in delay discounting. These findings indicate that high delay discounting precedes the initiation of smoking and predicts the trajectory of smoking but that it may not distinguish between discrete states of smoking. Identifying heightened delay discounting in

young people may offer the opportunity to target intervention resources more effectively, by preventing excessive smoking trajectories before they are initiated.

Synaesthete musicians: insights at the intersection of psychology, neuroscience, and artistic practice

Solange Glasser, University of Melbourne, Australia

Synaesthesia presents a rare but powerful lens through which to examine the interplay between perception and creative cognition. This presentation explores how synaesthetic experiences shape the ways musicians think, feel, and behave, with a focus on the implications for understanding underlying neural and cognitive mechanisms. Drawing on psychological research, semi-structured interviews with synaesthete musicians, and d/art/a (data and art) collected during artistic processes captured in virtual reality (VR), I consider how cross-modal associations influence musical development and support the creative process. Framing these insights within the broader context of cognitive neuroscience, I aim to address two key questions: How can musicians' phenomenological accounts challenge or refine our laboratory-based models and theories of synaesthesia? And what reciprocal insights can neuroscience offer to artists seeking to understand and harness their synaesthetic experiences? By situating lived experience alongside neuroscientific inquiry, this talk argues for a dynamic dialogue between disciplines: one that integrates phenomenology, creativity, and neural evidence. Such a framework not only deepens our theoretical understanding of synaesthesia but also highlights its translational value for artistic practice, offering a model for collaborative research across psychology, neuroscience, and the arts.

An empirical and immersive interpretation into lived synesthetic experiences of musicians

Zinia Chan, University of Melbourne, Australia

Solange Glasser, University of Melbourne, Australia

Ben Loveridge, University of Melbourne, Australia

Zinia Chan's co-interdisciplinary research using Virtual Reality with support from UniMelb's Immersive Lab, takes on an immersive and empirical investigation into the role of synesthesia in an artist's practice. The research focus is to not only respond to original music created through the process of painted sketches, but to allow for audiences to experience the researcher's own emotions and synaesthetic responses. Due to this process being highly reliant on the cognitive and empirical experience of the researcher, emotive and real-time responses were tracked to narrow down the correlation between aural stimuli and the live VR artwork produced. The researcher first responded to their original APRA AMCOS and Australian Music Centre Award 'Work of the Year' Finalist composition, 'Gaze Upon the Liquid Sky' with limited reference to the original painting to capture the emotions, colours and textures evoked, which is mapped in the Virtual Reality space, Tiltbrush using The University of Melbourne's Immersive Lab equipment. Resulting in a final virtual reality walk-through, this allowed for a tangible and immersive comparison to the original painting created during the compositional process of writing 'Gaze Upon the Liquid Sky'. Further, this approach highlights the nuances, cognitive implications, and importances of how personal history and understanding influences our experiences with art viewing.
Funding: Supported by The University of Melbourne's Immersive Lab.

Exploring the structure of synaesthetic colours: do synaesthetic colours cluster by basic colour terms of native languages?

Anton Sidorov, School of Psychological Sciences, Performance and Expertise Research Centre, Macquarie University

There is ample evidence that language influences perception, meanwhile it is debated whether the qualitative characteristics of involuntary sensory experiences in synaesthesia ('concurrents') are non-randomly shaped through learning and exposure. Our study investigates the structure of colour concurrents in Russian and English-speaking synaesthetes, focusing on whether such concurrents discretely cluster around culturally salient colour categories. Contrary to expectations, our preliminary results show no reliable clustering for either

language group. In particular, the blue range, often reported as an area of lexical and perceptual distinction in Russian with the well-documented compulsory difference in usage of dark blue ('sinij') and light blue ('goluboj'), did not yield distinct internal subdivision in concurrents. The analysis likewise showed no distinct groupings for the basic colour terms, either twelve in Russian or eleven in English. These findings may suggest that synaesthetic colour experiences do not systematically align with linguistic basic colour terms or exhibit clear categorical boundaries, even in domains where language provides fine-grained and well-established differences. Absence of discrete clusters raises new questions about the influence of lexical systems and perceptual categorisation in "non-random" inducer-to-concurrent correspondences. We discuss implications for the theories of conceptual influences, ideasthesia and linguistic relativity for understanding synaesthesia, and the relationship between perceptual categorisation and synaesthetic colour space structure.

Immunometabolic dysregulation associates with brain atrophy in depression and predates illness onset

Ye Ella Tian, Department of Psychiatry, Faculty of Medicine, Dentistry and Health Sciences, The University of Melbourne

Depression often presents with co-occurring physical health conditions, including heart disease, diabetes, and obesity. While dysregulation of the immunometabolic system is posited to underpin several of these physical comorbidities, the prevalence and course of immunometabolic dysregulation in depression is poorly understood and its impact on structural brain changes linked to the disorder is unknown. Using brain imaging and high throughput metabolomics data from the UK Biobank, we comprehensively evaluate cross-sectional and longitudinal immunometabolic profiles in depression, including systemic inflammatory markers and metabolites related to lipid, glucose and amino acid metabolism. Crucially, we find that immunometabolic dysfunction predates illness onset

(7 years on average), manifesting a relatively persistent pattern over time of elevated inflammation, upregulated very-low-density lipoprotein and lipids, and downregulated high-density lipoprotein. We also map network-level systemic changes in metabolites in depression, implicating the core role of glycolysis. We show that peripheral immunometabolic dysfunction, particularly elevated inflammation, is associated with brain gray matter atrophy. We conclude that altered lipids and inflammatory markers predate the onset of depression, remain altered throughout the illness course, and explain the severity of brain atrophy. By comprehensively profiling immunometabolic dysfunction in depression and related brain changes, our work highlights the importance of treating chronic low-grade inflammation and altered lipid and glucose metabolism in the disorder.

Disentangling white matter alterations across psychotic-like experiences, early psychosis and cannabis use disorder: A Fixel-Based Analysis approach

Isabella Goodwin, Neuroscience of Addiction and Mental Health Program, Healthy Brain and Mind Research Centre, School of Behavioral and Health Sciences, Faculty of Health Sciences

Psychotic disorders are highly debilitating mental health conditions and commonly co-occur with cannabis use disorders (CUD), yet the underlying neurobiology is unclear, particularly in individuals who experience subclinical psychotic-like experiences. Understanding the neurobiology underlying subclinical psychotic-like experiences and comorbid CUD may help identify prognostic markers and minimise harm associated with both conditions. We applied Fixel-Based Analysis, a diffusion-weighted imaging framework sensitive to white matter microstructure, across three studies. In Study

1 (n=41), participants were sampled across a uniform distribution of psychotic-like experiences. Study 2 used data from the IMAGEN consortium (n=1,098), replicating analyses with greater power and a larger population-based distribution. In both cohorts, we hypothesised greater psychotic-like experiences would correlate with reduced fibre density or cross-sectional morphology. No significant associations were observed after controlling for covariates, across whole-brain and tract-specific analyses (FWE-corrected p>0.05). Study 3 analysed

diffusion data from the Human Connectome Project for Early Psychosis, including 116 first-episode psychosis (FEP) patients (26 with CUD, 92 without) and 50 controls. FEP patients showed significantly reduced fibre density compared with controls, but no differences emerged between those with and without CUD. The findings suggest that white matter alterations may be specific to clinical psychosis, with no detectable alterations in subclinical psychotic-like experiences, supporting the view that such alterations may emerge only at diagnostic threshold. While CUD increases psychosis risk, its impact on white matter in early illness remains unclear, emphasizing the need for further longitudinal studies.

Leveraging resting-state fMRI to characterise neural network alterations underpinning craving in alcohol use disorder

Antonio Verdejo-Garcia, School of Psychological Sciences and the Turner Institute for Brain and Mental Health at Monash University

Alcohol use disorder is associated with neural alterations in cortico-striatal pathways relevant to craving. However, the nature of these pathway alterations has been mostly characterised using nonhuman animal models, due to the limitations of conventional fMRI analyses. Spectral dynamic causal modelling (spDCM) is an analytical approach that leverages resting-state fMRI sequences to characterise the valence (excitatory or inhibitory) and directionality (top-down or bottom-up) of neural connections. This approach has important advantages both in terms of characterisation of the neural circuits underpinning alcohol use disorder and scalability for clinical use. Here, I will present

findings from spDCM analyses implemented in a pooled dataset from the ENIGMA-Addiction consortium, comparing effective connectivity within the cortico-striatal network associated with alcohol craving in people with alcohol use disorder (n=452) versus healthy controls (n=239). Using a Parametric Empirical Bayes framework, we found strong evidence (Pp > 0.99) indicating that people with alcohol use disorder show increased influence of the dorsal striatum on the ventromedial prefrontal cortex and reduced influence of the right insula on the left insula. These findings align with neurobehavioural models of alcohol use disorder and contribute to understanding the neural network underpinnings of craving.

Can a brief mindfulness intervention reduce resting state functional connectivity alterations in cannabis use disorder? A double-blind MRI trial

Hannah Thomson, Neuroscience of Addiction and Mental Health Program, Healthy Brain and Mind Research Centre, School of Behavioral and Health Sciences, Faculty of Health Sciences

Cannabis use disorder (CUD) affects approximately 50 million people globally and is associated with persistent use despite attempts to quit, adverse health outcomes, and altered brain functional connectivity examined with resting-state fMRI. Mindfulness-based interventions (MBIs) can reduce cravings and brain dysfunction in substance use disorders (SUDs), yet their effects on the neurobiology of CUD remain unexplored. We conducted the first RCT in CUD to explore whether a brief MBI known to reduce drug craving, compared to active and passive placebo conditions, reduced altered resting-state functional connectivity between selected regions-of-interest and the rest of the brain. Regions-of-interest were selected for their relevance to the addiction neurocircuitry, CUD and dense innervation in cannabinoid receptors. Fifty-six people (14 females)

with a CUD, underwent fMRI and behavioural assessment pre-to-post MBI (n=19); active placebo (relaxation, n=18); or passive placebo (no intervention, n=19). Intervention-by-time effects on rsFC and subsequent correlations between resultant region pairings and behavioural variables were examined. There was an intervention-by-time effect on resting-state functional connectivity between the putamen and pallidum seeds with voxel clusters. Putamen-frontal pole rsFC and putamen-SFG rsFC decreased pre-to-post MBI; and increased pre-to-post active and passive placebo; putamen-frontal pole rsFC in correlation with decreased cannabis use. Thus, a brief MBI, relaxation,

and daily monitoring could reduce aberrant integrity of brain pathways underlying CUD. Future research with larger samples, who endorse motivation to change use and adhere to intervention requirements, is required to confirm on how brief MBI mitigate brain dysfunction in CUD.

Recreational substance use and neurodevelopment: findings from multimodal longitudinal consortia

Valentina Lorenzetti, Neuroscience of Addiction and Mental Health Program, Healthy Brain and Mind Research Centre, School of Behavioral and Health Sciences, Faculty of Health Sciences

The consumption of psychoactive substances is common in youth and has been associated with altered neurodevelopment in pathways implicated in disinhibition, emotion regulation, craving/stress. Whether neurobiological changes predate or follow youth substance use (or both) remains unclear. I will present three multimodal MRI studies from longitudinal global consortia. In the IMAGEN consortium, cannabis user vs. control youth (age 19), showed different resting state functional connectivity between extra-striate, somatomotor, temporo-parietal and ventral prefrontal areas; in correlation with sensation seeking/impulsivity. Cannabis vs. control groups also showed altered white matter microstructure (fibre cross-section) in the superior longitudinal fasciculus/corpus callosum using Fixel-Based Analysis of diffusion-weighted imaging data. Prior to cannabis use (age 14), there was no difference in functional connectivity, but prospective cannabis users showed altered white matter in the superior longitudinal fasciculus, in correlation with age of cannabis use onset. In structural MRI analysis in youth from the Brazilian-High-Risk consortium assessed over 3 times (age 9, 13 and 17), inferior frontal gyrus volumes were larger before alcohol use onset vs. no use at baseline. In prospective alcohol users vs. controls, amygdalas were larger at baseline, increased less from baseline-to-T2 and declined more from T2-to-T3. Superior frontal gyrus

volumes decreased in male drinkers and increased in male controls over time; while in females, controls did not change, but drinkers showed decreases from baseline-to-T2 then increases from T2- to-T3. Overall, recreational alcohol/cannabis use may affect neurodevelopment in distinct pathways as a function of sex.

Self-reported anxiety and Electroencephalogram measures following single-dose MDMA or psilocybin in healthy volunteers

Samantha Lee Webb, School of Medicine and Psychology, The Australian National University

Neil Wayne Bailey, School of Medicine and Psychology, The Australian National University

Bernadette Mary Fitzgibbon, School of Medicine and Psychology, The Australian National University

Prabhavi Perera, School of Medicine and Psychology, The Australian National University

Paul Bernard Fitzgerald, School of Medicine and Psychology, The Australian National University

Although psychedelics have been investigated for treating psychiatric disorders where anxiety commonly co-occurs (e.g., depression and post-traumatic stress disorder), few studies have targeted anxiety outcomes specifically. This electroencephalographic (EEG) sub-study is embedded within the ASSESS trial ("A study of the psychological, cognitive and physiological effects of Psychedelic Medicines", ACTRN12622001535763p) and examines anxiety-related changes following a single group-administered dose of MDMA or psilocybin in healthy volunteers. Participants completed one preparation session, a drug exposure session (2–4 people per session), and an integration session within 72 hours of dosing. Anxiety was measured with the State-Trait Anxiety Inventory (STAI) at baseline, one-week post-dose, and at 3-month follow-up. EEG recordings were obtained at baseline and one-week post-dose.

The study included 48 participants; 25 initially received MDMA and 23 psilocybin. Ten participants crossed over from MDMA to psilocybin and six from psilocybin to MDMA, yielding 31 MDMA and 33 psilocybin dosing sessions. STAI data is available for 25 MDMA and 27 psilocybin participants and EEG data is available for 28 MDMA and 30 psilocybin participants. Planned analyses will compare pre- and post-dose STAI scores and EEG recordings. Exploratory analyses will examine anxiety-related EEG markers (e.g., event-related potentials and the error-related negativity) from cognitive tasks such as the emotional Stroop and Go/No-Go.

It is hypothesised that both self-reported anxiety and anxiety-related EEG markers will be reduced one week after dosing relative to baseline for both medications. These findings could

support the use of psychedelic-assisted therapies for anxiety and contribute to understanding the neural mechanisms underlying their therapeutic effects.

Symposium: Motor Learning and Plasticity

Neural oscillations in motor skill acquisition in typical and clinical populations

Jarrad Lum, Deakin University

Motor skill acquisition relies on complex neural dynamics that coordinate sensory information processing and motor execution. This presentation examines the role of cortical oscillatory activity during procedural motor learning in healthy children (n = 38) and adults (n = 85), as well as in children with motor difficulties (n = 19). Across two studies, we used electroencephalography to track changes in oscillatory activity as participants implicitly learned a motor sequence.

In healthy adults, motor learning was accompanied by decreases in midline theta (4–8 Hz) activity, suggesting disengagement of top-down attentional processes, alongside learning-related modulations of beta power (12–30 Hz) over motor areas, likely reflecting bottom-up sensorimotor encoding. These dual processes may operate in concert, with theta supporting executive control and beta facilitating motor sequence discovery. These theta and beta modulations were largely replicated in healthy children aged around 10 years. In children with motor difficulties, however, these oscillatory dynamics were selectively disrupted. While theta modulations remained intact, beta oscillations over motor cortex showed significantly reduced modulation during learning, suggesting that impaired bottom-up sensorimotor processing may be one mechanism underlying motor learning difficulties.

These findings have important therapeutic implications, particularly for paediatric groups with motor difficulties. Intervention approaches that strengthen bottom-up sensorimotor integration, rather than higher-order processes, may prove more effective. Together, these results highlight the role of beta dynamics in supporting procedural motor learning across development.

Symposium: Motor Learning and Plasticity

An acute bout of high-intensity cardiovascular exercise facilitates online motor skill learning

Emily Brooks, Monash University

Previous studies have demonstrated that exercise can influence motor skill learning. However, the specific components of learning primed by exercise remain unclear. This study examined the effect of a preceding bout of high intensity interval training (HIIT) on the acquisition of a novel motor skill. The investigation focused on whether improvement in skill across the session was attributable to online gains during active practice or offline rest periods between practice blocks. There was also exploration as to whether common polymorphisms of the BDNF and DRD2/ANKK1 genes that regulate plasticity, learning, and memory, influenced the relationship between exercise and motor learning. It was demonstrated that HIIT enhanced skill acquisition, but that the effects of HIIT priming were not specifically attributable to within-session online or offline learning processes. Contrary to research on overnight consolidation, there was no interaction between BDNF, nor DRD2/ANKK1 genotype, with exercise primed skill learning.

Symposium: Motor Learning and Plasticity

The effects of repeated exercise priming on motor skill consolidation

Joshua Hendrikse, Monash University

An acute bout of high-intensity interval training performed prior to motor skill practice enhances learning and consolidation. However, the potential for repeated doses of HIIT to elicit cumulative effects remains unclear. This study aimed to investigate the effects of multiple bouts of HIIT priming on motor skill learning. Participants completed five 20-minute sessions of exercise paired with practice on a sequential visual isometric pinch task (SVIPT), where exercise consisted of either HIIT (n = 24) or a low intensity active control condition (n = 24). As predicted, priming skill learning with HIIT led to greater skill gains relative to controls, and these effects were retained for at least one week post training. Overall, repeated bouts of exercise priming may offer an effective strategy to facilitate learning and skill consolidation. Future work is required to examine the neurophysiological mechanisms underlying these effects and

potential clinical utility.

Symposium: Motor Learning and Plasticity

Delivering combined transcranial magnetic and electrical stimulation to induce motor cortex plasticity and improve motor adaptation

Jane Tan, Murdoch University

Explicit motor adaptation is the ability to adjust movements in response to sensory feedback, such as changes in body position or environmental changes. It is a vital component of motor control that allows us to interact with complex and dynamic environments. Declines in explicit motor adaptation is a major contributor to age-related declines in motor control. Furthermore, both motor cortex plasticity and motor adaptation is impaired in individuals with Parkinson's disease (PD). Therefore, explicit motor adaptation is an important target for neurorehabilitation in both healthy ageing and PD. The aim of the current project was twofold. First, we investigated the effects of a non-invasive brain stimulation protocol that combines intermittent theta burst stimulation and transcranial alternating current stimulation (iTBS-tACS) on motor cortical activity and explicit motor adaptation in healthy younger participants. Second, we tested whether iTBS-tACS can induce plasticity in the motor cortex in individuals with PD. Preliminary findings indicate that iTBS-tACS has the potential to improve explicit motor adaptation in healthy younger adults and increase motor cortex excitability in PD.Non-invasive brain stimulation interventions that induce plasticity offer promise for enhancing motor learning and reducing motor impairments in individuals with movement disorders.

Symposium: Computational Modelling of Cognition

Mutual advantage at the interface of cognitive modelling and neuroscience

Simon Farrell, University of Western Australia

This talk will give an overview of some topics and concepts relevant to the detailed talks in this section. I will discuss the general approach taken in mathematical psychology and cognitive modelling, and some characteristics of work in that field that have led to rigorous and coherent theoretical development. In this spirit of the other talks in the symposium, I will consider how mathematical psychology might benefit cognitive neuroscience, and also how EEG, fMRI and other methods might offer to answer questions that cannot be answered purely on the basis of modelling of behavioural data, as well as attempts to bridge across and unify behavioural and neuroscientific data.

Symposium: Computational Modelling of Cognition

On the formation of routines and their impacts on control: harnessing cognitive neuroscientific insights to build mathematical models of cognition

Kelly Garner, UNSW

Routines are a pervasive feature of daily life, yet how and why we form routines remains understudied. Here, I will demonstrate how current understanding of sequential behaviours falls short of explaining key elements of routines, particularly their self-chosen, idiosyncratic nature. Drawing from cognitive neuroscientific investigations into stereotypical sequence learning, I will outline a novel method for capturing and quantifying individual differences in the self-constructed ordering of behaviours that underlie a routine. Based on this method, I will present a model of the cognitive processes that shape routine formation, which reveals insights into how and why individuals form varying representations of their task environment. Further, I present evidence that dopamine modulates the extent to which individuals settle for suboptimal routines, and the role routines may play in supporting flexible and controlled performance. By linking insights from cognitive neuroscience to the development of formal models, these findings offer a window into how humans form idiosyncratic representations of multi-step tasks, why we may sometimes form ineffective routines, and why they effectively support regulation of behaviour.

Symposium: Computational Modelling of Cognition

Rethinking representational assumptions in cognitive modelling:implications for

cognitive neuroscience

Christina Van Heer, University of Melbourne

Cognitive models often assume participants behave similarly because they share a common generative model of latent processes (e.g. reward contingencies or volatility) inferred from noisy observations. Variability in behaviour is typically attributed to differences in how precisely people infer these latent states, or computational constraints on how inference is implemented (e.g. belief updating). However, using a common generative model presupposes that participants represent the task in the same way as our model does. My work questions this critical assumption. Even when the task structure is learnable or known, individuals may vary in how much they commit to using that structure, a concept I refer to as representational commitment. Viewed this way, behavioural variability may reflect different i) generative models of the world, ii) representational commitments to this model, or iii) underlying computational mechanisms. This has important implications for cognitive neuroscientists: if participants do not share the same representational assumptions, variability in neural representations may reflect deeper heterogeneity in mental models and their associated computations. I will present results from a series of predictive learning tasks where we placed people in task environments which vary in their predictability. Even within the same experimental environment, participants showed striking diversity in how they used the available structure, suggesting people differ both in how they represent their environment, and how the brain might compute within this environment. Combining hierarchical Bayesian and computational cognitive modelling approaches, I demonstrate how mathematical psychology's theoretical frameworks offer principled tools for characterising this diversity.

Symposium: Computational Modelling of Cognition

A parietal memory-strength signal linked to evidence accumulation in recognition decisions

Jie Sun, University of Melbourne

Recognising objects from memory requires an integration of sensory and mnemonic information. The mnemonic accumulator hypothesis suggests that this process occurs via a stochastic evidence accumulation process implemented within the parietal cortex. Recent evidence suggests that the parietal Late Positive event-related potential Component (LPC) demonstrated novel features of mnemonic accumulators. Here, we investigated this hypothesis using a combination of electroencephalographic (EEG) recordings and generative computational modelling based on the Diffusion Decision Model (DDM). We recorded EEG from 24 participants in a recognition memory task with word stimuli. We first demonstrated that the widely studied LPC was time-locked to the response and the pre-response amplitudes systematically varied with reaction times and memory strength manipulations. These features suggest a link between LPC and mnemonic strength variable in evidence accumulation. To further test this link, we fit the DDM jointly to trial-level pre-response LPC amplitudes and behavioural data using specialised neural network tools. Our results revealed that LPC amplitudes were selectively associated with the rate of evidence accumulation—reflecting memory strength. This association was stronger for previously studied words than for novel words and was most pronounced for signals occurring closer to the response. Our findings therefore recast the LPC as a neural signature of mnemonic strength in evidence accumulation for recognition memory judgments, and provided support for the parietal mnemonic accumulator hypothesis.

Symposium: Computational Modelling of Cognition

Multivariate classification shows associative learning reduces working memory load

William Ngiam, Adelaide University

The amount of information that can be maintained in mind – or working memory capacity – is sharply limited. Longstanding debate about the nature of this capacity limit stems from disagreement on the representational 'unit' of working memory'; some argue for an item-based limit, whereas others argue for resource-based limits. A recent trend amongst cognitive neuroscientists is to use machine learning with neuroimaging data to decode the contents of working memory. But what is being decoded? We should not rely on simply using a "working memory task" to declare we are decoding working memory. Without a reliable theory or formal model constraining what a working memory representation is and is not, interpretation will

be very difficult. I will argue that the complexity of modelling working memory is unappreciated – that there is a plurality of viable models. I will present one formal model of working memory recall in the whole-report task (Ngiam et al., 2024), which dovetails with recent successful decoding of item-based load in working memory (Thyer et al., 2022). I will then show recent empirical work exploring how this multivariate signature of item-based load changes with associative learning. The key result is that decoding differs between subjects who show explicit learning and those who do not. Learners show a reduction in item-based load (in line with 'chunking'), but multidimensional scaling reveals this reduction is not straightforwardly explained with pure item-based models. Thus, I hope to demonstrate that progress can be made with careful iteration between formal modelling and neuroimaging.

Symposium: Curiosity and Creativity

Neurocomputational mechanisms underlying perceptual and epistemic curiosity

Jocelyn A. Halim, Monash University

Daniel Bennett, University of Melbourne

Trevor T.-J. Chong, Monash University

Curiosity is fundamental to human behaviour. Traditionally, it has been dichotomised into two subtypes: perceptual curiosity refers to the desire for information about sensory stimuli, whereas epistemic curiosity refers to the desire to obtain new knowledge. Recent frameworks suggest that both subtypes of curiosity may be driven by a shared underlying desire to reduce uncertainty about our knowledge of the world. However, this hypothesis has yet to be formally tested. Here, we asked whether the value of perceptual and epistemic information rely on shared or separate neurocomputational mechanisms. Across separate tasks, we asked healthy young adults to decide how much effort they were willing to invest to reduce their uncertainty about the identities of blurred stimuli (perceptual curiosity task), or the outcome of pre-determined lotteries (epistemic curiosity task). Each participant completed both tasks within an fMRI environment. We found that across both perceptual and epistemic tasks, participants became more likely to seek information – and more willing to exert effort as a cost – as uncertainty increased. We further found a correlation between participant's subjective valuations of perceptual and epistemic information, suggesting a relationship between the two types of curiosity. Supporting this, model-based fMRI showed that the value of perceptual and epistemic information correlated with activity across a network of corticostriatal areas. However, each task also engaged nodes that were unique to perceptual and epistemic curiosity. Together, these findings support a general mechanism through which reducing uncertainty motivates curiosity-based behaviours, while highlighting the complexity of curiosity as a multifaceted construct.

Symposium: Curiosity and Creativity

The neural basis of creative thought: A functional neuroimaging study

Melody M. Y. Chan, The University of Queensland

Matthew A. Lambon Ralph, University of Cambridge

Gail A. Robinson, The University of Queensland

Creative thought drives human progress. From daily problem solving to world-changing inventions, our ability to generate novel ideas is vital across all aspects of life. Despite its central role in humanity, the cognitive science of creativity remains surprisingly underdeveloped. Most research has treated creativity as a specialised skill, rather than exploring how it arises from core systems of the human mind. We have proposed the Cognitive Cornerstones Hypothesis of creative thought, which posits that creative thought is not a specialised faculty but emerges from general purpose cognitive mechanisms supporting semantic cognition, controlled episodic memory retrieval, and executive mechanisms. To test this hypothesis, we conducted a within-subjects functional magnetic resonance imaging (fMRI) study with healthy participants (age 18-40). They completed both verbal and nonverbal creativity tasks, alongside cognitive tasks tapping each of the three cognitive cornerstones. We discovered three major observations. First, both verbal and nonverbal creative tasks engaged networks implicated in semantic cognition, episodic memory, and executive control. Second, these domain general cognitive systems did not operate in isolation; rather, they dynamically interacted to support both verbal and nonverbal creative tasks. Third, while verbal creativity showed stronger engagement of left-lateralised semantic and executive regions, and nonverbal creativity recruited a more bilateral fronto-parieto-temporal network, both creative tasks consistently drew upon the three cornerstones. These findings support the Cognitive Cornerstones

Hypothesis of creative thought. Creative thought reflects flexible coordination among semantic, episodic and executive systems, with distinct patterns of engagement depending on the nature of creative activity.

Symposium: Curiosity and Creativity

Investigating the role of inhibitory control in creative thought using transcranial magnetic stimulation

Eugene Cho, The University of Queensland

Melody M.Y. Chan, The University of Queensland

Martin V. Sale, The University of Queensland

Matthew A. Lambon Ralph, University of Cambridge

Gail A. Robinson, The University of Queensland

Creative thought involves generating novel ideas and evaluating them for usefulness. Despite being a hallmark of human cognition, its underlying cognitive and neural mechanisms remain debated. The domain-general perspective asserts that creativity emerges from the interplay between a wide range of well-established cognitive processes and brain regions. One such candidate is inhibition (or inhibitory control), an executive function implicated in both idea generation and evaluation. The present study used non-invasive brain stimulation to examine whether inhibition plays a causal role in creative thought, and whether the right lateral prefrontal cortex is critically involved. In a multi-session, within-subjects design, healthy adults (aged 18-40 years) underwent repetitive transcranial magnetic stimulation (rTMS) targeting the right inferior frontal gyrus (rIFG), with the vertex serving as a control site. Pre- and post-stimulation, participants completed classic creativity tasks—Alternate Uses Test (AUT) and Remote Associates Test (RAT)—modified to manipulate inhibitory control demands via congruent and incongruent contextual cues. At a purely behavioural level, significant congruency effects were observed across both tasks, inferring that better inhibitory control facilitates creative performance. rTMS, however, did not produce statistically significant changes in the magnitude of congruency effects. Nonetheless, visual inspection of post-stimulation results revealed differences between active and control conditions in the AUT study, hinting at a potential causal role of the rIFG. These findings support a link between inhibition and creative cognition.

Symposium: Curiosity and Creativity

Effort-based decision-making: an experimental framework to understand motivation loss in Huntington's and Parkinson's disease

Lee-Anne Morris, University of Otago; New Zealand Brain Research Institute

Kyla-Louise Horne, University of Otago; New Zealand Brain Research Institute

Laura Paermentier, New Zealand Brain Research Institute

Christina Buchanan, Auckland City Hospital

Michael MacAskill, New Zealand Brain Research Institute

Daniel Myall, New Zealand Brain Research Institute

Sanjay Manohar, University of Oxford

Matthew Apps, University of Birmingham

Masud Husain, University of Oxford

Richard Roxburgh, Auckland City Hospital; University of Auckland

Tim Anderson, University of Otago; New Zealand Brain Research Institute; Christchurch Hospital

Campbell Le Heron, University of Otago; New Zealand Brain Research Institute; Christchurch Hospital

Apathy is a prominent, debilitating behavioural change in people with Huntington's disease (HD) and Parkinson's disease (PD). One approach to investigate the mechanisms underlying apathy is to use a theoretical framework of normal motivated behaviour, to determine where breakdown has occurred. Weighing up the costs and rewards associated with actions is a fundamental computation underlying motivated, goal-directed behaviour across species. In separate experimental studies, people with HD (n = 53) and PD (n = 51) performed an effort-based decision-making task and underwent multimodal MRI (PD), whilst a distinct PD cohort with longitudinal follow-up underwent multimodal MRI (n = 199). Behavioural data was analysed using logistic regression and drift diffusion models, and neuroimaging data was analysed using a regions-of-interest approach. In both HD and PD, apathy was associated with reduced acceptance of offers to exert effort for reward,

whilst non-apathetic performance was comparable to controls. Reduced acceptance was driven by reduced incentivisation by low reward in PD and increased aversion to high effort costs in both PD and HD. Furthermore these changes (in PD) were reflected in altered connectivity between striatum and dorsal anterior cingulate cortex – the same regions where our separate PD cohort exhibited changes associated with the evolution of motivation loss. Alterations to the cognitive processes involved in effort-based decision-making and the neural networks subserving these processes are evident in people with Huntington's and Parkinson's disease apathy. More broadly, this work highlights the value of applying robust theoretical frameworks to understand complex symptoms such as apathy in neurological disease.

Symposium: Curiosity and Creativity

Creative idea generation in healthy and pathological ageing

Gail A. Robinson, The University of Queensland

Ohnmar Aung, The University of Queensland

Georgia Marsh, The University of Queensland

Creativity refers to the ability to produce ideas or actions that are novel and useful. The notion of creativity has typically incorporated convergent and divergent thinking. Currently, there has been little focus on what changes occur in creativity in the context of neurodegenerative disease or with disease progression such as for Alzheimer's disease (AD) and mild cognitive impairment (MCI). This study therefore addressed this gap and examined the patterns of creativity in both healthy and pathological ageing. We recruited individuals with MCI (n = 23), AD (n = 21), and matched healthy controls (n = 36). AD and MCI diagnoses were determined by neurological examination, neuropsychological assessment and review of the neuroimaging (MRI), based on clinical diagnostic criteria. Amyloid burden was quantified via positron emission tomography (PET). Groups were compared on measures of creativity and cognition (intelligence, memory, language, executive function). In addition, we explored (1) whether performance on a creativity task could predict clinical group and (2) the relationship between creativity and contributing cognitive processes. Our findings suggested that creative thought is reduced in individuals with MCI and AD, such that the AD group generated the lowest number of correct responses and made the most errors on all creativity tasks. Performance on creativity tasks could also predict clinical group. This depended on the specific creativity task, ranging from 49% to 82% of those having MCI, indicating sensitivity to novel idea generation, which has been linked to frontal lobe impairment. These findings suggest that the ability to produce new ideas decreases as dementia progresses. Further, that core cognitive processes underlying creativity, including semantic knowledge and executive functions, are critical for producing new creative thoughts.

Symposium: Predictive Processing

Concurrent neuro, behavioural, and physiological evidence worse representational fidelity of expected visual events

Reuben Rideaux, University of Sydney; The University of Queensland

Ziyue Hu, The University of Queensland

The temporal context in which sensory events are embedded shapes how they are processed by the brain. Statistical regularities in the environment facilitate expectations about upcoming sensory input, which can be leveraged to process this information more electively and eliciently. There are two potential mechanisms that could be applied in the brain to utilize expectation. Neural responses to expected events could be dampened or sharpened. Both mechanisms reduce metabolic expenditure associated with expected sensory input; however, dampening would also reduce the representational fidelity of expected events while sharpening would lead to an improvement. Numerous attempts to adjudicate between these accounts have produced strikingly contradictory evidence. Two possible contributing factors to this inconsistency are inadequate establishment of expectation under traditional experimental paradigms, e.g., probabilistic cueing, and the confounding elects of other neural phenomena, i.e., sensory adaptation and attention. To address these issues, here we developed a new experimental paradigm that facilitated exposure to thousands of probabilistic visual events (spatially defined targets), while allowing for separation of adaptation, attention, and expectation. To assess the influence of expectation on sensory processing, observers were tasked with reporting the location of (expected/unexpected) targets while their neural activity and pupil diameter were recorded with

electroencephalography and eye tracking. Our pupillometry measures confirmed that unexpected events elicited surprise, while our behavioural and neural recordings provided complimentary evidence that expected events were represented with reduced fidelity compared to those that were unexpected. These findings support the dampening account of expectation, which may serve to prioritize unexpected events.

Symposium: Predictive Processing

Expect the unexpected: What can the observations of 7000 people tell us about the effects of expectation on visual perception?

Dragan Rangelov, Swinburne University of Technology

Reuben Rideaux, University of Sydney; The University of Queensland

Jason B. Mattingley, The University of Queensland

The brain receives more sensory information than it can use to guide adaptive behaviour. This overload can be reduced by exploiting regularities in the environment to predict future events. Predictive coding theory assumes that the perceptual system suppresses expected input. Recent research has shown that expected visual stimuli are perceived with lower precision than unexpected stimuli, both neurally and behaviourally. It remains unclear, however, whether such prediction effects arise only for isolated visual features (e.g., orientation) or whether they generalise across features within a common object (e.g., from orientation to colour). Conceptually, generalisation across features may either be automatic or a consequence of prior task-relevance. The automaticity of expectation effects for task-irrelevant features, therefore, can only by estimated from a single, surprising trial. To address these questions, we recruited 7,000 people to participate in an online study as part of the Perception Census Survey. Half estimated the orientation of a single chromatic grating, and the other half its colour. Several gratings were presented serially in each trial, with the task-relevant features (e.g., orientation) following a predictable – clockwise or counterclockwise – sequence with the final, target grating being either expected (in-sequence) or unexpected (random). The task-irrelevant feature (e.g., colour) varied randomly. In the final trial of the study, participants received a surprise request to report the stimulus feature that was hitherto task irrelevant. Computational modelling of response precision using these last-trial data revealed significantly lower perceptual precision for expected than unexpected gratings, demonstrating automatic generalisation of expectation effects across visual features.

Symposium: Predictive Processing

Differential effects of expectation on perceptual and neural measures of visual object processing

Phuong Dang, The University of Queensland

Jason B. Mattingley, The University of Queensland

Margaret J. Moore, The University of Queensland

According to predictive accounts of brain function, efficient and accurate processing of sensory information is achieved by modelling current and future perceptual states. Previous research has shown that neural responses to visual features are modulated by predictions, but less is known about how these neural effects are related to changes in behaviour. Here, we presented statistically structured rapid serial visual presentation (RSVP) sequences in which, unbeknownst to participants, the identity of presented objects was ordered so that they were either expected, unexpected, or random based on a preceding stimulus. Participants viewed the RSVP sequences across separate, counterbalanced sessions in which we measured either behavioural responses, or brain activity using electroencephalography (EEG). The behavioural task required participants to provide speeded responses to pre-specified target objects within the sequence. Participants were more accurate for expected objects than random or unexpected objects, whereas their response times were slower for unexpected objects relative to random or expected objects. This pattern of results was consistent regardless of session order (i.e., completing the task before or after the EEG session). Multivariate pattern analyses of the EEG recordings revealed that stimulus-specific information was reduced for both expected and unexpected objects relative to random objects. Such reduction relative to random objects, however, emerged in only either expected or unexpected objects depending on session order, suggesting an effect of learning on neural response patterns. Together, the findings suggest differential

effects of expectation on behavioural and neural measures of visual object processing and imply an important contribution of incidental learning.

Symposium: Predictive Processing

Perception and prediction in psychosis: Preliminary findings from the 'PRIOR' study

Elise Rowe, The University of Melbourne

Tracy Colgan, The University of Melbourne

James Reeve, The University of Melbourne; Orygen

Chinh-Suan Lin, The University of Melbourne

Eric Chen, Orygen

Barnaby Nelson, The University of Melbourne; Orygen

Stephen Wood, The University of Melbourne; Orygen

Suresh Sundram, Monash University; Monash Health

Marta I. Garrido, The University of Melbourne

Psychotic disorders are severe mental health conditions that are marked by disruptions to perception and disconnection from reality. While neurotypical individuals integrate sensory information (likelihood) and prior expectations when forming perceptions - it is theorised that individuals with psychosis show alterations to these processes, however, the underlying neurobiological mechanisms are still poorly understood. To address this, our 'PRIOR' study examines perceptual processing across the psychosis spectrum using advances in neuroimaging including ultra high-resolution layer fMRI at 7T and optically-pumped magnetoencephalography (OP-MEG). We aim to recruit four groups (each with N=30): individuals at-risk of developing psychosis (UHR), those who have experienced a first episode of psychosis (FEP), people with chronic psychotic illness within the schizophrenia spectrum (SZ) and neurotypical individuals (NT). Each participant will complete: (1) a behavioural 'coin-task' examining how prior and likelihood information are combined, (2) the 'hollow mask illusion' during layer fMRI examining the neural encoding of prior expectations in deep cortical layers and (3) an auditory 'volatility mismatch negativity' paradigm during OP-MEG recordings examining whether (prior) expectation violations manifest as brain connectivity alterations. We predict that individuals with psychosis will display lower reliance on prior expectations and increased weighting on incoming sensory information. This will be evidenced by: (1) overweighting of the likelihood in the behavioural task, (2) decreased activity in cortical layers receiving top-down feedback and/or increased activity in feedforward layers during the hollow-mask visual illusion, (3) decreased modulation of mismatch negativity auditory responses. In this talk, I will discuss the preliminary findings from our first six months of recruitment.

Symposium: Development

Working memory strategies in children aged 7 to 10 years

Caitlin Hrysanidis, Monash University

Regine Cassandra Lau, Monash University

Peter J. Anderson, Monash University; Murdoch Children's Research Institute; Children's Hospital of Orange County; University of California Irvine

Linda Ramirez Herrera, Monash University

Susan Gathercole, University of Cambridge

Joshua F. Wiley, Monash University; Peter MacCallum Cancer Centre

Megan Spencer-Smith, Monash University

The use and effectiveness of working memory strategies reflect how well individuals can optimise limited-capacity systems through the engagement and coordination of neural networks. While working memory strategies have been examined in adults, much less is known about their use in children. This study investigated self-reported strategy use in children aged 7 to 10 years on working memory tasks, including those with demands related to everyday and classroom activities. The sample comprised 63 children who participated in a larger working memory training trial, which showed no improvements in outcomes up to six months post-intervention (Lau et al., 2024). At the immediate post-intervention follow-up, children completed five working memory tasks: two backward span tasks (letters, digits), two following instructions (letters, objects) and one n-back task (objects). Semi-structured one-on-one interviews were then conducted to assess the strategies children used on each task. Strategy use was common across tasks and generally associated with higher performance.

Children reported using a range of task-general and task-specific strategies, tended to rely on single rather than multiple strategies, and favoured a manipulation over a maintenance strategy type. While specific strategies, number of strategies and strategy type were related to performance on certain tasks, associations were not consistent across all tasks. These findings indicate that, as in adults, children's strategic behaviour supports performance on working memory tasks relevant to daily learning and activities. Future research building on this work is needed to better understand the development, use, and effectiveness of children's working memory strategies.

Symposium: Development

Exploring the Strategy Mediation hypothesis as a cognitive mechanism of working memory training in children

Megan Spencer-Smith, Monash University

Caitlin Hrysanidis, Monash University

Peter J. Anderson, Monash University; Murdoch Children's Research Institute; Children's Hospital of Orange County; University of California Irvine

Susan Gathercole, University of Cambridge

Joshua F. Wiley, Monash University; Peter MacCallum Cancer Centre

Working memory training studies in children are in abundance, but few examine the underlying cognitive mechanisms of the observed limited transfer and changes in brain networks and function. This study aimed to contribute understanding by exploring assumptions of the Strategy Mediation hypothesis, a promising account from adult studies that suggests training promotes the generation of task-specific strategies that support performance on outcome tasks similar in structure to training activities. We used data from a previous randomized controlled trial evaluating working memory training methods in primary school children (7-11 years) who completed adaptive training (n=147) or an active control (n=50), comprising 10 sessions (total training 175-225 minutes) in class over two weeks. At baseline, immediately and 3-months post-intervention children completed (1) four working memory tasks: two Backward Span and two Following Instructions (same paradigms used in training), and (2) a strategy questionnaire. Children reported using a range of strategies on working memory tasks at baseline, with most using task-general (76-83%), some using paradigm-specific (16-24%), and very few using task-specific strategies (0-1%). The use of task-general and paradigm-specific strategies was generally stable, which did not differ between training and control conditions immediately and 3-months post-intervention. In general, the strategies used were not associated with working memory performance, which did not differ between conditions. Our dataset provides little support for assumptions of the Strategy Mediation hypothesis in children. We speculate that increased training time could support the efficient application of strategies important for children's task performance.

Symposium: Development

Behavioural and neural correlates of post-error slowing in the ABCD developmental dataset

Iroise Dumontheil, University of Melbourne

Liam-Francis Dunne, University of Melbourne

By noticing errors, individuals can learn from unexpected outcomes and appropriately adapt their behaviour. A key marker of performance monitoring is the fact that participants slow down after an error (post-error slowing, PES). PES can be adaptive, reflecting a greater engagement of executive control after an error that leads to higher post-error accuracy. However, PES can also be maladaptive and reflect a capture of attention by the error, away from the task. There is mixed evidence regarding developmental differences in PES, likely because experimental task differences affect the balance between adaptive and maladaptive PES. Here, we calculated robust measures of PES from three tasks of the Adolescent Brain Cognitive Development (ABCD) study dataset (stop-signal, emotional Stroop and emotion n-back) to (i) compare the developmental trajectory of PES across tasks, (ii) assess associations between individual and developmental differences in PES magnitude and measures of attention and executive control, and (iii) investigate associations between PES magnitude and resting state functional connectivity in the cingulo-opercular, fronto-parietal and salience networks. Data from the version 5.1 release include measures from baseline (age 9-10 years) to 4-year follow-up. Linear mixed model analyses indicated that, while trends differed somewhat

between trial types and tasks, PES tended to decrease with age. Longer PES was associated with worse executive functioning and less connectivity between fronto-parietal and salience networks. PES measures in the ABCD dataset therefore likely reflects maladaptive adjustments in behaviour after an error. This research contributes to our understanding of individual and task factors affecting PES over development.

Symposium: Development

Post-error slowing and adolescent metacognition

Kali Chidley, The University of Queensland

Paul E. Dux, The University of Queensland

Amaya J. Fox, The University of Queensland

Adrian Herbert, The University of Queensland

Annemaree Carroll, The University of Queensland

Stephanie Macmahon, The University of Queensland

Natasha Matthews, The University of Queensland

Adolescence is a developmental period associated with significant changes in brain structure and function, particularly in cortical regions that support higher-order functions, contributing to the protracted maturation of cognitive abilities that facilitate adaptive behaviour. The ability to adaptively adjust behaviour is critical for successful functioning and has been linked to metacognitive processes. One prominent behavioural adjustment is post-error slowing (PES): an increase in reaction time after an individual makes an error. There has been widespread debate regarding whether PES is an adaptive behaviour that reflects top-down control processes or nonadaptive behaviour that reflects bottom-up attention orientation. Critically, an adaptive behaviour should positively impact goal-directed outcomes. However, there are mixed findings as to whether PES improves task performance, which may be partially attributable to the performance cost incurred by increasing reaction time. Here, we proposed an alternative approach by investigating post-error slowing in self-paced preparation time. Adjustments in self-paced preparation have previously been linked to higher metacognition and improved task performance in adolescence, but these relationships have not been explored for error related adjustments. To address this gap, 139 adolescent participants (11-15 years) completed a self-paced cued task-switching paradigm and offline measures of metacognition. Adolescents demonstrated significant preparation time and reaction time slowing following errors. Importantly, post-error preparation slowing magnitude was positively related to better performance (accuracy, reaction time, and switch cost) and to enhanced metacognition/strategic knowledge. These results demonstrate that post-error preparation slowing is an adaptive behaviour related to individual differences in metacognition during the developmental period of adolescence.

Symposium: Brain Stimulation

Translating network mapping findings into targets for therapeutic transcranial magnetic stimulation

Ellen Younger, Deakin University

Transcranial magnetic stimulation (TMS) has been used as a treatment for disorders such as depression, however, its effective application to other neurological and psychiatric disorders has been limited. A major limiting factor to the broader clinical use of TMS has been our inability to identify areas within the brain that underlie symptom regulation and would be appropriate TMS targets. As a potential solution, network mapping methods have been used to localise functional and structural brain networks underlying disorders and symptoms with previously unclear substrates. Retrospective analysis of existing brain stimulation therapies has shown the therapeutic relevance of these networks, and thus, these methods are now being used to identify prospective TMS targets. Early clinical trials have very recently begun to test the efficacy of targeting these sites with TMS. This talk will provide an overview of commonly used network mapping methods and discuss evidence for using these techniques to identify targets for TMS. Practical factors will then be highlighted for researchers to consider when translating network mapping findings into testable targets for TMS clinical trials. These considerations include the selection of a brain network to stimulate based on network mapping findings, feasibility and tolerability, TMS electric field distribution, coil orientation, and how network mapping results may inform the type of TMS to apply. Overall, this talk aims to encourage the translation of network mapping findings into TMS targets and promote a pragmatic approach to defining and testing these targets in clinical trials.

Symposium: Brain Stimulation

Neuromodulation in movement disorders: Using functional connectivity in stimulation targeting

Elizabeth Ellis, Deakin University; University of Turku and Turku University Hospital

Brain stimulation techniques are increasingly used in the treatment of movement disorders, particularly deep brain stimulation (DBS). Recent evidence has shown that the benefits of DBS critically depend on the precise anatomical localization of the stimulation. The effects of this stimulation, however, are not restricted to the targeted tissue but extend across large-scale rain networks. Indeed, the structural and functional connections of the DBS target site can be associated with specific symptoms of a disorder (e.g. tremor in Parkinson's disease), or even with side effects of the stimulation (e.g. neuropsychiatric changes). In dystonia, for example, symptom improvement following pallidal DBS has been associated with connectivity of the target site to somatomotor and cerebellar structures, whilst in Parkinson's disease the DBS targets most strongly connected to a circuit encompassing the anterior cingulate, hippocampus, cerebellum and caudate were associated with worsening cognitive decline post-DBS. Thus, it is now suggested that identification of the brain networks underlying these disorders can be a powerful tool to identify and validate treatment targets. This talk will discuss how mapping the functional connectivity of causal brain lesions in movement disorders can be relevant to neuromodulation therapy. With a focus on hemichorea-hemiballismus, one of the most common post-stroke movement disorders, this presentation will draw upon multimodal evidence of the relationship between neuromodulation and connectivity in movement disorders, such as Parkinson's disease and dystonia, and demonstrate how Lesion Network Mapping can identify brain networks that may guide optimization of stimulation for hemichorea-hemiballismus.

Symposium: Brain Stimulation

Efficacy of network mapping-guided continuous theta-burst stimulation in cervical dystonia: A randomised controlled pilot trial

Jordan Morrison-Ham, Deakin University

Cervical dystonia (CD) is a neurological disorder characterised by involuntary contractions of the neck muscles. Underlying neural mechanisms driving this disorder have been largely unclear, which has hindered the search for effective, non-invasive treatments. Lesion network mapping (LNM) was recently applied to CD, deriving a causal network from brain lesions, and reconciling the prior inconsistencies in the neuroimaging literature. Results from this work indicated a possible shared neuroanatomical substrate for both idiopathic and acquired CD within the somatosensory cortex (S1), with connectivity between this S1 region and deep brain stimulation treatment targets associated with a greater symptom benefit in CD. Critically, this S1 region serves as a viable target for non-invasive brain stimulation. Here, we conducted a randomised controlled crossover pilot trial of continuous theta-burst stimulation (cTBS) to the S1 LNM node to determine whether stimulation of this network could reduce CD symptoms. Thirteen CD participants (57.85 years ± 10.85, 2 male) received two 2-week blocks of both active and sham cTBS (10 sessions/block, 2-week washout) to the S1 bilaterally. Measures of symptom severity (primary outcome), video assessments, and neurophysiological outcomes were collected at several timepoints across both blocks (sessions 1, 5, 10, two weeks post-cTBS). Resting-state functional connectivity was assessed pre and post cTBS blocks. Whilst there were no significant interaction effects (timepoint x condition) for CD symptoms or neurophysiological outcomes, there were significant changes in functional connectivity from subcortical deep brain stimulation treatment targets to cortical motor regions, suggesting a downstream effect of the intervention.

Symposium: Brain Stimulation

The therapeutic application of repetitive transcranial magnetic stimulation in autism: Findings from a randomised controlled trial

Briella Rodriguez, Deakin University

Autism spectrum disorder (ASD) is characterised by social communication difficulties, including challenges with face

processing. Repetitive transcranial magnetic stimulation offers a promising neuromodulatory therapy to improve these challenges. This study forms part of a large multisite, double-blind, randomised controlled trial investigating the therapeutic effects of intermittent theta burst stimulation (iTBS) applied to the right temporoparietal junction (rTPJ) in autistic individuals. Participants (N = 101, aged 14-40 years, M = 22.28, SD = 7.42; 57 male, 44 female) received four weeks of either active or sham iTBS (600 pulses at 70% resting motor threshold) to the rTPJ (20 sessions), targeted via MRI(T1)-guided neuronavigation. Outcomes discussed in this presentation include neuropsychological measures of face memory, recognition, and facial emotion recognition, and clinical measures assessing depression, anxiety, stress, personal wellbeing, and global functioning. While the clinical trial is ongoing (anticipated completion October 2025), interim analyses of 66 participants at three time points (baseline, immediately following the intervention, and one-month follow-up) revealed a significant interaction between time and condition on the Benton Facial Recognition Test ($F(2,128) = 5.32$, $p = .006$, $\eta^2_p = 0.08$), with active iTBS participants showing improved face recognition performance compared to sham at one month ($p = .016$). These preliminary findings suggest that iTBS targeting the rTPJ can enhance face processing in autism, highlighting potential clinical applications of neuromodulation for social cognition deficits. Final analyses, including the full sample and extended follow-up assessments (three and six months), will be conducted using mixed models and presented during the symposium.

Symposium: Brain Stimulation

The neurophysiological effects of theta burst stimulation as measured by electroencephalography: A systematic review

Bridgette Speranza, Deakin University

Theta burst stimulation (TBS) is a non-invasive brain stimulation technique that can facilitate or suppress corticospinal activity. TBS is increasingly being used experimentally, and for therapeutic purposes. However, evidence suggests individual responses to TBS protocols are variable, and the effects of TBS on cortical regions beyond the motor cortex, and on widespread cortical networks remain unclear. We synthesized local and distal electrophysiological effects of TBS as measured by electroencephalography (EEG), and concurrent TMS-EEG in non-clinical, human participants. While some evidence suggests continuous TBS (cTBS) suppresses, while intermittent TBS (iTBS) facilitates evoked response component amplitudes, the effects of these protocols across EEG outcomes were variable. Variability in response to TBS protocols was exacerbated by the addition of task stimuli. Additionally, there was a large degree of methodological heterogeneity across studies included for review, and few studies examined the effect of individual differences known to contribute to TBS response variability. Future research investigating the effects of TBS must consider methodological and individual factors that may affect response.

Symposium: Brain Stimulation

The 'Big NIBS data' project: The world's first open-source data sharing repository for noninvasive brain stimulation data

Michael Barham, Deakin University

Non-invasive brain stimulation (NIBS) refers to a suite of neuromodulatory techniques used clinically as a treatment option for neurological and psychiatric disorders, and experimentally to investigate functioning of the nervous system. Until recently, a limitation of the NIBS field has been accessing a resource in which clinicians and researchers can easily share and access NIBS datasets. To address this gap, the 'Big NIBS data' project recently launched 'www.bignibsdata.com': the world's first and only open-access data sharing repository for NIBS data alongside our 2025 publication in Brain Stimulation. Inspired by the existence data repositories for many other types of neuroscience techniques like EEG and MRI, and modelled after the OpenNeuro approach to neuroimaging data sharing, our repository aims to increase data FAIRness (Findable, Accessible, Interoperable, Reusable) in the NIBS field. We demonstrate how easier data sharing practices will facilitate researchers to perform 'big' data analyses, which in the NIBS field will accelerate understanding of inter-individual variability of response and enable clinicians to create patient-specific NIBS treatment protocols to increase clinical outcomes.

Symposium: Traumatic Brain Injury

White matter microstructure and cognitive performance variability in health and brain injury

Jake Burnett, Deakin University

Traditional research has emphasised mean-level differences in cognitive performance between groups, such as slower reaction times (RT) in traumatic brain injury (TBI) patients than healthy adults. This focus has overshadowed intraindividual variability (IIV), including trial-by-trial or day-by-day fluctuations in performance, which growing evidence suggests is itself a sensitive marker of cognitive and neural health. Here, we investigated the relationship between IIV and white matter characteristics of the superior longitudinal fasciculus (SLF) in healthy adults and individuals with mild TBI. In Study 1, 30 healthy adults completed a cognitive battery and ecological momentary assessments (EMAs) of working memory and RT (1 session/day for 30 days). In Study 2, 11 mTBI patients (~1 year post-injury; age 26–61, 5 females) and 22 matched controls (age 21–57, 11 females) completed the same tasks. Diffusion MRI data were analysed using fixel-based analysis to derive fibre density (FD), fibre cross-section (FC), and combined fibre density and cross-section (FDC) of the SLF. This presentation will demonstrate that consistency in cognitive performance is associated with white matter structure, positioning IIV as a potential behavioural marker of neural health across both healthy and clinical populations.

Symposium: Traumatic Brain Injury

Improving cortical parcellation in ms-TBI: tackling lesion-induced errors with inpainting and standardised quality control

Evelyn Deutscher, Deakin University

Traumatic brain injury (TBI) is a leading cause of disability worldwide, yet accurate prognosis of moderate-to-severe TBI (ms-TBI) remains a significant challenge due to the heterogeneity of pathology and outcomes. This work explores how ms-TBI focal lesions on T1w MRI scans can cause errors in automated neuroimaging tools, reducing the reliability of quantitative brain metrics used to improve understanding of this heterogeneous condition. We focused on lesion-induced errors in cortical parcellation, specifically investigating lesion inpainting and improved visual quality checking as potential methods for mitigating these errors. First, we identified the facilitators and barriers for adopting lesion inpainting in ms-TBI research, informing the future development of inpainting tools optimised for use in ms-TBI. We then quantitatively investigated the use of an inpainting tool called Virtual Brain Grafting (VBG), in conjunction with FastSurfer, an advanced parcellation tool. While VBG was critical for enabling successful parcellation in the presence of large lesions, it did not improve overall parcellation accuracy. Furthermore, to address the frequent parcellation errors observed in both lesioned and lesion-free images, we developed and validated ENIGMA's Advanced Guide for Parcellation Error Identification (EAGLE-I), a comprehensive resource enabling consistent identification and recording of errors across raters with minimal prior experience. Collectively, promoting the integration of lesion inpainting and transparent identification and recording of parcellation errors into neuroimaging pipelines lays the groundwork for improving cortical parcellation in ms-TBI research. Focusing on accurate, reproducible methods, this work lays the foundation for improving prognostication and treatment, supporting a future of precision medicine in ms-TBI.

Symposium: Traumatic Brain Injury

Detection of brain injuries using portable ultra-lowfield MRI and artificial intelligence in patients with acquired brain injury

Juan F Domínguez D, Deakin University

Karen Caeyenberghs, Deakin University

Assessment of brain injuries using high-field MRI scans is critically important after sustaining an acquired brain injury. However, healthcare professionals reveal that there are several barriers for high strength MRI usage, including the availability of the scanner, safety concerns and cost. Ultra-low field MRI may provide a solution for these various issues as it is a more cost-effective option, it provides a more compact and portable system, it can be safer for certain patients, and it does not require restricted access or specifically designed shielded rooms. While ultra-low field MRI has a reduced resolution and substantially lower signal-to-noise ratio compared to high-field

MRI, novel artificial intelligence techniques are being developed that may improve the image quality of the ultra-low field MRI data. In this presentation, we present results of a study where we used an image-to-image translation deep learning model to improve the quality of ultra-low-field (64mT) MRI scans to generate synthetic high-field (3T) MRI scans in a group of patients with acquired brain injury. This proof-of-concept study offers valuable insights into structural changes in the brain, potentially aiding in lesion identification and in the diagnosis and management of patients with brain injuries.

Symposium: Traumatic Brain Injury

Neurofeedback as an Intervention for Persisting Postconcussion Symptoms following Mild Traumatic Brain Injury

Sarah Hellewell, Curtin University

More than 180,000 Australians sustain mild traumatic brain injuries every year. Most individuals recover within two weeks, however between 20-50% experience persisting post-concussion symptoms (PPCS) in the months-to-years following injury. PPCS are heterogenous but often involve executive function, with difficulties in working memory, attentional control, planning, task initiation and emotional regulation. There are few treatment options addressing the brain dysfunction underlying these symptoms. Neurofeedback is a technique that utilises operant conditioning to reward desired oscillatory brain activity, as detected using quantitative electroencephalography (qEEG). Several small studies suggest that neurofeedback may improve cognitive dysfunction in people with PPCS, though the biological mechanisms through which this may occur are unknown. We are conducting a clinical trial evaluating the efficacy of personalised neurofeedback as compared to undirected training (to control for effects of environment) and control (no treatment). Participants with PPCS from injuries occurring six months to four years prior are randomised to group, with those in the neurofeedback and undirected training group attending 18 training sessions over six weeks. Our outcome measures evaluate pre-post treatment changes in brain structure and function (MRI: brain volume, resting state functional MRI, myelin water imaging, diffusion imaging; blood and saliva biomarkers: NF-L, tau, UCH-L1, GFAP, cortisol) alongside cognitive assessment (Repeated Battery for the Assessment of Neuropsychological Status, Trail Making Tests A&B) and self-reported symptoms. This work will determine whether neurofeedback has specific effects on persistent cognitive dysfunction incurred following injury, and for the first time will link these potential effects to biological changes within the brain.

Symposium: Traumatic Brain Injury

Characterising heterogeneity in brain morphology in traumatic brain injury using normative modelling

Jake Mitchell, Monash University

Traumatic brain injury (TBI) is heterogeneous, complicating efforts to develop standardized diagnostic and therapeutic approaches. Conventional group-based analyses often obscure individual differences by averaging across diverse injury patterns. In contrast, by comparing deviation from the expected distribution observed in healthy controls, normative modelling captures patient-specific deviations from expected norms. In this study, we applied traditional case–control and a normative modelling approach to cortical and subcortical magnetic resonance imaging (MRI). Data was analysed from the ENIGMA Consortium Adult Moderate-to-Severe TBI Working Group. Primary outcome measures were cortical thickness and subcortical volumes, derived from the two different frameworks. Overall, 631 (407 TBI, 224 controls) MRIs were processed. During this presentation, we will show that normative modelling is able to detect participant-specific cortical and subcortical abnormalities that conventional group comparisons overlook, better representing the true diversity of TBI-related morphological changes. Generating individualised 'morphological fingerprints' may advance prognostic accuracy and lay the foundation for personalised interventions in research and clinical practice.

Symposium: Traumatic Brain Injury

Subcortical grey matter volumes in Australian footballers: examining normative deviations, longitudinal changes, and associations with head impact metrics

Spencer Roberts, Deakin University

Collision athletes may experience abnormal atrophy of subcortical grey matter. This study examined the subcortical grey matter of Australian football (AF) players, including normative deviations in volumes, volumetric changes across a season, and relationships with head impact metrics. Nineteen players had T1w MRI scans taken pre-season. Hippocampus, amygdala, thalamus, caudate nucleus and putamen volumes were calculated using FreeSurfer, and their normative deviations computed using CentileBrain. The proportion of players with infra- and supra-normal volumes for each region was determined. A subset (n=13) of players had post-season MRI scans, allowing for comparison of volumetrics pre- vs post-season. Pre-season volumetrics were correlated with head impact history metrics (e.g., years of AF, age-at-first AF exposure), while a sample (n=8) that had whole-season head impact exposures monitored using instrumented mouthguards were used to explore relationships between head impact exposures and changes in subcortical volumes. This presentation will show that male AF players often have abnormal atrophy of the putamen and caudate nucleus, and these regions show decreases in volume across an AF season.

Symposium: Computational Psychiatry

Computational psychiatry: using mathematical modelling to understand aberrant perception, predict diagnosis, and map brain regions to symptoms

Marta Garrido, The University of Melbourne

Computational Psychiatry is an emerging new field that uses mathematical modelling with two major goals: 1) to build new AI-inspired psychiatric instruments to aid diagnosis, prognosis, and treatment; and 2) to understand the mechanisms underpinning aberrant experiences in people with a psychiatric condition. In this talk I will present our recent contributions to both goals. Relevant to the first goal, I will demonstrate the usefulness of prediction error alterations combined with data-driven AI methods for informing diagnosis and mapping brain regions to specific psychotic symptoms. The second goal is theoretically driven. I illustrate this approach showing that conflicting Bayesian models can explain the occurrence of altered perceptual experiences via either top-down or bottom-up processing aberrancies. I will show how we have empirically adjudicated between these theoretical models using mathematical models. By using a task with excellent test-retest reliability (73%) we show across two datasets (discovery dataset n=363; validation dataset n=782) that psychotic-like experiences were associated with an overweighting of sensory information relative to prior expectations, driven by decreased precision in priors. However, participants with greater psychotic-like experiences also encoded likelihood information with greater sensory noise. We propose a revised theoretical model for perceptual inference in psychosis, whereby both prior and sensory representations are less precise when psychotic-like experiences increase, but their relative imprecision is such that it leads to an overreliance on likelihood information, in keeping with bottom-up theories.

Symposium: Computational Psychiatry

Computational modelling a translational tool

Elizabeth Fisher, University of Sydney; Monash University

Computational modelling offers a translational tool in psychiatry, enabling researchers to bridge findings from animal studies to human clinical contexts. Computational models capture information-processing mechanisms that underlie behaviour and allow for direct comparisons across species. To illustrate this approach, I will present research using computational models to investigate optimism bias in rats following psilocybin treatment. Psilocybin has emerged as a promising intervention for depression, with clinical studies linking its post-acute effects to enhanced mood and reduced pessimism. However, the underlying computational mechanisms remain poorly understood. Animal models of psilocybin treatment have a number of benefits as they circumvent issues with expectancy effects and allow for the ability to collect many data points. In our study, rats completed a novel two-armed bandit reversal learning task designed to assess engagement and adaptability. We fit both active inference and reinforcement learning models to the behavioural data, revealing that psilocybin-treated rats achieved more rewards through greater task engagement, driven by altered forgetting rates and reduced loss aversion. These results suggest that psilocybin

induces an optimism bias via changes in belief updating—a mechanism with clear translational relevance for understanding and treating mood disorders in humans.

Symposium: Computational Psychiatry

Beyond behaviour: computational modelling of effort and reward valuation in the human brain

Huw Jarvis, Monash University

Trevor T.-J. Chong, Monash University

A key strength of computational modelling is that it allows researchers to go beyond descriptive analyses of behaviour and make inferences about underlying cognitive mechanisms. In this talk, I will discuss a study in which we used computational modelling to reconcile the dual function of dopamine in supporting both effort exertion and reward-based learning – two seemingly disparate processes that are often altered in disorders of dopaminergic dysfunction (e.g., Parkinson's disease, schizophrenia, ADHD). We tested healthy human adults (N = 42) on a novel reward-based learning task in which they registered their responses by applying physical force to a pair of hand-held dynamometers. Participants were randomised to receive either sulpiride 800 mg (a selective post-synaptic D2 receptor antagonist) or placebo in a double-blind design. In the placebo group, the exertion of effort promoted more efficient learning from positive outcomes, and less efficient learning from negative outcomes. Critically, this effect of effort on learning was found to be absent in the sulpiride group. Together, these data demonstrate that effort and learning operate within a common computational framework that is reliant on intact dopamine signalling, inviting further investigation of how whether this mechanism may be disrupted in clinical populations with dopaminergic dysfunction.

Symposium: Computational Psychiatry

Promise, ethics, and practicality in computational psychiatry, perspectives from the clinic

Jayson Jeganathan, University of Sydney; Mind Oasis Clinic

Innovations in computer science have a special relevance to psychiatry, because the brain's role is fundamentally computational. The computational lens offers a new perspective on familiar symptoms. For instance, anxiety can be reframed as an imbalance in explore vs. exploit. In this talk, Dr Jeganathan will discuss the promise, ethics, and practicality of translating computational results to the clinic. Our recent work on measuring facial affect provides a springboard for discussing the clinical transability of computational results. Facial affective blunting is a core symptom in schizophrenia. Measuring facial expressivity invariably invokes a clinician's subjective judgement. We developed new methods to objectively measure facial expressivity. Individuals viewed emotional movies. Facial video recordings were analysed with machine learning and a Hidden Markov model to label their moment-to-moment facial dynamics. Individuals with schizophrenia had reduced responsivity to joke punchlines, and spent more time in low facial activity states. These results highlight the promise of quantitative approaches to measure symptoms, but ethical and practical limitations must be addressed to facilitate clinical translation. Concerns about data privacy arise because computational methods collect "big data" from facial movements, physiological measures like heart rate, or brain recordings. Computational models can be seen as "black boxes", limiting trust and interpretability. In this regard, simpler models from cognitive psychology, with models. Finally, collaborative frameworks between scientists and clinicians are essential to advance the goal of integrating new computational approaches into clinical practice.