ABSTRACTS

PRESIDENT'S INVITED LECTURE
Thursday 25th 14:00

Recovery from aphasia after stroke: from networks to therapy

Dorothee Saur
University of Leipzig

In my talk, I will summarize my work on the mechanisms of plasticity in language networks. As a neurologist, I will approach this topic from a strong clinical perspective. To understand how lesions cause aphasia, we first need to know how language is organized in brain networks. On this basis, the main part of my talk will be devoted to neural mechanisms for the reorganization of language. This includes studies in which short-term plasticity is induced with transcranial magnetic stimulation in healthy volunteers and chronic stroke patients, but especially neuroimaging studies in stroke patients with aphasia. Finally, I will address the question of how these mechanisms could be used for network therapies and how the outcome and response to therapies could be predicted individually.

21ST ELIZABETH WARRINGTON PRIZE LECTURE
Thursday 25th 11:00

Mapping the neurobiology of language: from anatomy to the clinic

Stephanie Forkel
Donders Institute for Brain, Cognition and Behaviour, Radboud University

Each brain is distinct, with anatomical differences becoming more pronounced in the face of lesions or pathological changes. In this talk, we will look at the neurobiology of language in the brain and delve into insights from clinical cohorts that shed new light on the intricate networks that facilitate language processing in health and disease. These connections are the foundation of functions, including language, that emerge from the interaction between brain areas. This talk showcases how modern neuroscience, building on historical clinical-anatomical studies, offers insights into the brain's language landscape and its implications for understanding neurological disorders.

Wednesday 24th April 2024

09:50 **Investigating the oscillatory dynamics of tics in Tourette Syndrome**

Mairi Houlgreave[1], Aikaterini Gialopsou[1], Elena Boto[1], Matthew Brookes[1] & Stephen Jackson[1]
[1]*University of Nottingham*

In Tourette Syndrome (TS), premonitory urge is thought to be a negative reinforcer of tic expression, suggesting that tics may be a voluntary response to these sensations. Here, we explore the oscillatory changes within the primary motor cortex and regions associated with urge, the right insula and cingulate cortex, during tics. Optically Pumped Magnetometer (OPM) MEG data were acquired from 16 participants with TS. Participants were asked to complete two paradigms: the first paradigm involved sixty 10 second trials involving a single index finger abduction; the second paradigm involved 4 alternating 5-minute blocks of "Rest" and "Suppress" where participants were instructed to try to suppress their tics. Analyses of the timecourses of mu-alpha and beta frequencies, from the contralateral motor cortex, demonstrated significant desynchronisation during voluntary movement. However, there was no significant beta rebound. In contrast, there was no significant desynchronisation at tic onset across the bilateral motor cortices. The mid-cingulate cortex and right insula showed no significant changes in mu-alpha and beta timecourses before, or at tic onset. Our finding of desynchronisation during volitional movements, but not tics, is in-line with previous EEG research. Therefore, our data support the hypothesis that the oscillatory dynamics involved in tic generation differ from that of voluntary movement, suggesting that tics may be involuntary. Regardless, OPM-MEG was shown to be capable of recording participants with TS during their tics where conventional methods such as EEG have previously shown artefacts associated with tic onset.

10:10 **A novel test of conjunctive binding shows impaired associative processes in working memory in neuropsychiatric disorders**

Giovanni d'Avossa[12] & Mohammad Zia Ul Haq Katshu[34]
[1]*School of Psychology and Sport Sciences, Bangor University,* [2]*Betsi Cadwaladr University Health Board,* [3]*Nottinghamshire Healthcare NHS,* [4]*University of Nottingham*

Working memory impairments are prevalent in developmental and acquired neuropsychiatric disorders. Traditionally, these are assessed using span measures whose face validity relies on versions of the 'slot model', namely the idea that working memory has access to few memory fields, each containing information about a single token, whether it be an object, word, or number. According to this model, working memory functionality can be assessed by the number of accessible fields or slots and the ability to sort them in a task relevant fashion. The slot model, however, has been challenged by various recent observations. An alternative 'dynamic resource model' suggests that visual working memory contains layered processes, with distinct representations of basic visual dimensions and their object and group membership. The storage of both features and their conjunctions have finite capacity, thus limiting recall precision and accuracy. We developed a conjunctive working memory task which probes the ability to bind features of different, easily distinguishable visual dimensions. The task places minimal demands on feature memory, thereby reducing the likelihood of feature confusion contributing to binding errors. We used this task to examine patients with medial temporal lobe and neurodevelopmental disorders. Patients show large decrements in associative performance which specifically or preferentially involve the integration of space,

rather than shape, to colour. We suggest that this task could be used to ascertain the integrity of associative processes in visual working memory. A shorter version of the task, which requires less than 10' to complete on a digital tablet, is available.

10:30 **What do retinotopic maps do? A lesion overlap analysis of visual functions in stroke patients**

Selma Lugtmeijer[1†], Aleksandra Sobolewska[2†], Edward de Haan[2345] & Steven Scholte[2]
[1]University of Birmingham, [2]University of Amsterdam, [3]Radboud University, [4]Oxford University, [5]Nottingham University, [†]Joint first author

'Visual binding' refers to the way in which features from the same object, that are analyzed separately are subsequently integrated. This idea is supported by the observation of many separate retinotopic maps that appear to be dominated by one aspect of the outside of the world, such as colour or motion. However, scrutiny of the available evidence does not necessarily support this functional segregation. For instance, neurons in these maps are often tuned to different visual primitives. An alternative view suggests that the structure of the visual system emerges through learning to encode the visual world on the basis of statistical consistencies in the world. In this view, the retinotopic maps reflect the covariances of types of information in the outside world, and not a priori categories like color and shape. The 'binding problem' is no longer a problem. The orthodox view predicts that there are areas in extrastriata cortex with a mapping to (some of the) features of mid-level vision. To test this, we employed atlas-based lesion-symptom mapping (LSM) to identify unique and shared lesion locations contributing to performance on colour, shape, location, orientation, contrast, glossiness, texture, and correlated motion tasks in a sample of 307 stroke patients. Processing of visual features was assessed with a diagnostic set-up sensitive to hemifield effects. LSM analyses show no evidence for a relationship between posterior lesions in specific brain areas and the processing of the 7 mid-level visual features. In contrast, and demonstrating the reliability of our methodology, the same LSM analyses did show that lesions related to visual field deficits map to the early visual cortex (V1, V2, V3). Our results challenge the traditional view of segregated processing and are consistent with the idea that the different visual maps constitute different constellations of (feature) information that co-occur in the external world.

10:50 **Comparing the Oxford Digital Multiple Errands Test (OxMET) to a real-life version: convergence, feasibility, and acceptability**

Sam S. Webb[1] & Nele Demeyere[1]
[1]University of Oxford

We aimed to assess the convergence, feasibility, and acceptability of the Oxford Digital Multiple Errands Test (OxMET) and the in-person Multiple Errands Test – Home version (MET-Home). Participants completed OxMET, MET-Home, Montreal Cognitive Assessment (MoCA), and questionnaires on activities of daily living, depression, technology usage, mobility, and disability. 48 stroke survivors (mean age 69.61, 41.67% female, and avg. 16.5 months posts-stroke) and 50 controls (mean age 71.46, 56.00% female) took part. No performance differences were found for healthy and stroke participants for MET-Home, and only found below $p = .05$ for OxMET but not below the corrected $p = .006$. Convergent validity was found between MET-Home and OxMET metrics (most $r>=.30$ & $p<.006$). MET-Home accuracy was related to age ($B= -0.04$, $p= .03$), sex ($B= -.98$, $p= .03$), disability ($B= -0.63$, $p= .04$), and MoCA ($B= .26$, $p<.001$), whereas OxMET accuracy was predicted

by MoCA score (B=.40, p<.001). Feedback indicated that the OxMET was easy and fun and more acceptable than the MET-Home. The MET-Home was more stressful and interesting. The MET tasks demonstrated good convergent validity, with the OxMET digital administration providing a more feasible, inclusive, and acceptable assessment, especially to people with mobility restrictions and more severe stroke. The MET home is more suited for more mobile stroke survivors where the assessing clinician has large amounts of time. The OxMET is more suitable where time is limited and the mobility of the participant is low.

11:40 **A neuropsychologically-informed TMS test of hemispheric dominance for visual shape processing**

Jessica A. Teed[1], Catriona L. Scrivener[1], Robert D. McIntosh[1] & Edward H. Silson[1]
[1]*University of Edinburgh*

A previously published case study presented a stroke patient, SM, with a right lateralised lesion resulting in object agnosia (Konen et al., 2011). This could suggest a right hemispheric (RH) dominance for object processing . We aimed to test this claim, hypothesising that TMS of shape-responsive visual cortex in the RH would cause a greater reduction in shape discrimination performance than TMS to the homologous left hemisphere (LH) region. Ten neurologically typical participants completed baseline psychophysical testing to determine individual shape discrimination thresholds. Bilateral TMS targets were then functionally localised through fMRI scans, and control sites (V5/MT+) within each hemisphere were defined using a probabilistic atlas. Participants then completed a same-different shape discrimination task with repetitive TMS over the LH or RH target or control site. Comparing experimental and control conditions in the RH or LH, or averaged across hemispheres revealed no significant differences in reaction time or sensitivity measures. However, when directly comparing experimental conditions between hemispheres, significantly elevated shape discrimination thresholds were associated with RH disruption. This pattern of results requires confirmatory follow-up but could be indicative of a right hemispheric dominance for visual shape processing.

12:00 **The Phenomenology of Face Blindness – a novel approach to Developmental Prosopagnosia**

Randi Starrfelt[1], Tone Roald[1] & Erling Noerkaer[1]
[1]*University of Copenhagen*

Developmental prosopagnosia (DP) is a neurodevelopmental disorder of unknown origin, characterized by lifelong difficulties with recognition of face identity. Once thought to be a rare disorder, current prevalence estimates range from 1-3%, with a stark increase in studies over the last ~15 years. These studies are mainly conducted within the framework of (cognitive) neuropsychology and neuroscience, building on experimental methods and models of face recognition derived from studies of acquired cases and functional neuroimaging. However, despite the dramatic increase in reported cases, many key questions remain unresolved: Is DP a result of mnemonic or perceptual impairment(s)? Does DP reflect a general deficit or a specific impairment in face processing? What can we learn about the neurotypical face processing system from studies of DP? We suggest the seeming similarity between developmental and acquired prosopagnosia has led to the focus on these questions, and have driven research on DP onto a very narrow path. We suggest instead to take a broader approach, starting with a description of the phenomenon at hand: What is it like to be

faceblind? How do people with DP experience perceiving, remembering and imagining faces? Building on classical phenomenological methods (as developed e.g., by Edgar Rubin in Copenhagen), we have conducted phenomenological interviews with participants with DP, aiming to elicit rich descriptions of their experiences with faces. Based on phenomenological analyses of these interviews, we will present case-examples of the types of descriptions given by DPs, and how they may reflect the underlying cognitive processes and impairments. Ultimately, this approach may lead to novel questions and hypotheses about the origins and core deficits in DP.

12:20 **Neural specialisation for concrete and abstract concepts: A meta-analysis of 71 neuroimaging studies**

Paul Hoffman[1] & Matthew Bair[1]
[1]*University of Edinburgh*

Neuropsychological studies suggest double dissociations in ability to comprehend concrete and abstract concepts, which may be explained by differential reliance on (a) modality-specific processing channels and (b) executive control over semantic processing. fMRI studies provide an important additional source of evidence in this debate. We present a new quantitative meta-analysis of this literature that includes twice as many studies as previous published analyses. This expansion of coverage allows us to formally test how neural concreteness effects overlap with functional brain networks of interest (e.g., action, social cognition and semantic control) are how they are influenced by three theoretically-relevant study characteristics: (1) verb comprehension (verb+ vs. verb-), (2) level of processing (sentences vs. single words), (3) task (semantic vs. non-semantic). Our analysis replicates established findings, showing that abstract concepts preferentially activate inferior prefrontal and anterior temporal cortex while concrete concepts activate medial temporal and parietal regions. However, while previous meta-analyses were highly left-lateralised, bilateral effects emerge in our larger dataset. We also find a striking correspondence between concreteness effects and proposed sub-divisions of the default mode network (DMN). Abstract words preferentially activate a frontotemporal DMN sub-network involved in language and social cognition while concrete words activate a medial temporal sub-network that supports memory and spatial cognition. When contrasting effects across different types of study, results converge with previous neuropsychological findings. For example, activation for abstract concepts in semantic control regions is more likely when people process these context words out of context, as predicted by studies of patients with semantic control deficits. Other findings support an embodied view of semantic representation: e.g., concrete activation in the action network is more prominent when people process verbs. While our results broadly support existing theories of concreteness effects, there are nonetheless some effects that are not easy to reconcile with current approaches.

12:40 **Multidimensional cognitive profiles of the logopenic variant of primary progressive aphasia and Alzheimer's disease**

Shalom K. Henderson[1,2], Matthew A. Lambon Ralph[1] & James B. Rowe[1,2,3]
[1]*Medical Research Council (MRC) Cognition and Brain Sciences Unit, University of Cambridge,* [2]*Department of Clinical Neurosciences, University of Cambridge,* [3]*Cambridge University Hospitals NHS Foundation Trust*

Data are mixed as to whether individuals with the logopenic variant of primary progressive aphasia (lvPPA) present with multi-domain cognitive impairments. In the current cross-sectional study, we asked whether lvPPA and Alzheimer's disease (AD) are discrete clinical entities or a multidimensional clinical spectrum. We tested the hypotheses that (1) clinical phenotypes of lvPPA and AD merge with overlapping cognitive features and (2) these features are associated with a specific and shared pattern of brain atrophy. We recruited 12 patients with a diagnosis of lvPPA, 12 with AD, and 12 age-matched healthy controls. The 24 lvPPA and AD patients were subdivided into 7 patients meeting diagnostic criteria for lvPPA at the time of testing (i.e., predominant language presentation), 8 mixed AD (i.e., exhibiting multi-domain impairments), and 9 typical AD (i.e., predominant amnestic presentation). Neuropsychological assessment scores spanning language, memory, and executive functioning domains were entered into a varimax-rotated principal component analysis (PCA). Scree plots and parallel analyses were used to select four principal components. Rey auditory verbal learning test (RAVLT) trials and delayed recall loaded most heavily on principal component (PC) 1 and thus we labelled this PC as 'verbal episodic memory'. Various semantic and visuoperceptual tasks loaded heavily on PC 2 which we labelled 'conceptual and perceptual processing'. Trails A, the Rey Osterrieth complex figure copy, immediate and delayed recall loaded heavily on PC 3 which we labelled 'visual construction and memory'. Naming, repetition, trails, and digit span loaded heavily on PC 4 which we labelled 'speech and motor output'. Results of our Bayesian ANOVAs revealed moderate to extreme evidence in favour of a group effect for the four PCs. At the BNS Spring Meeting, we plan to share our PCA and voxel-based morphometry findings.

14:30 **Exploring the neural bases of memory: theories, methods, and dichotomies**

Daniela Montaldi
University of Manchester

Our understanding of the neural bases of recognition memory has grown fast in the last 35 years, however, as with other very complex areas of science, as one question is answered another five emerge. Here I will describe some of the research that has contributed to this, with a view to illustrating the twists and turns, the debates, and challenges and, I will explore how, or indeed, whether, we have answered any of the key questions fully. Using the example of the medial temporal lobes, I will discuss why data and debates have not always advanced our progress as much as we might expect. I will describe our medial temporal lobe (MTL) cohort of patients (N>70) illustrating the different distributions of damage across the MTL components, and I will use this to demonstrate the challenges we face in attempting to explore the effects of selective lesions to these component regions, in more than just a few patients. Finally, I will stress the critical importance of human lesion work to this area of cognitive neuroscience and suggest some ways forward.

15:00 **From understanding E/I balance to personalised interventions for optimising cognition in typical and atypical development**

Roi Cohen Kadosh
University of Surrey

The intricate interplay of neuronal excitation and inhibition (E/I) holds a central key to understanding both typical and atypical cognition. This talk presents research dedicated to understanding the E/I-cognition link across development. Leveraging electroencephalography

(EEG) and magnetic resonance spectroscopy (MRS), we map and quantify E/I fluctuations in children, adolescents, and young adults, revealing a surprising shift in the E/I-cognition link from childhood to young adulthood. Adding another layer of complexity, our research highlights discrepancies in how various E/I measures capture this dynamic neural interplay. Recognising these nuances is crucial for interpreting findings and designing effective interventions. To establish a causal role of E/I in cognition, we explore transcranial random noise stimulation (tRNS) as a tool to enhance E/I levels to improve learning in healthy adults and alleviate symptoms in children with ADHD. Yet, our results indicate that personalisation is key. We introduce a novel approach—personalised Bayesian optimisation—leveraging AI to tailor tRNS parameters to individual characteristics, ensuring optimal benefit. This research paves the way for a comprehensive understanding of E/I and its multifaceted role in shaping cognitive functions. It not only offers a promising avenue for intervention through targeted E/I modulation but also underscores the need for a deeper exploration of this fundamental neural balance. Notably, personalised modulation holds the potential to unlock the power of this dynamic interplay and reshape human cognition.

15:30 **The neuropsychology of emotion**

Oliver Turnbull
Bangor University

Our understanding of the brain basis of emotion has changed enormously in the last 35 years. This talk outlines five principal findings from the field, with important theoretical and clinical implications. (1) That the experience of powerful emotions is a neurobiologically ancient phenomenon, subcortically mediated, and not disrupted by cortical lesions. (2) That the management or regulation of emotion is neurobiologically new, and relies especially on frontal and related structures. (3) That emotions can be surprisingly useful in helping us to make complex decisions, especially when they are based around unpredictable and uncertain events, and may be the brain basis of 'intuition'. (4) That emotion-related memories have a brain basis distinct from episodic memories, and can be selectively preserved in cases of classic amnesia. (5) That powerful unregulated emotions can lead to delusional beliefs. Taken together, these findings suggest that the neuropsychology of emotion has moved forward dramatically in the last few decades. Importantly, it also shows that emotion has a critical role to play in a wide range of psychological processes which are often regarded as purely 'cognitive', such as memory and decision-making.

16:30 **When the spark goes out: the neurology of apathy and motivation**

Masud Husain
University of Oxford

Disorders of motivation are common across brain disorders. One extreme is the syndrome of pathological loss of motivation – apathy. Unfortunately, we understand very little about the mechanisms underlying this condition. In this talk, I'll put forward a conceptual framework to understand apathy by considering the processes that normally underlie motivated, goal-directed behavior. I'll focus on the ability to generate options for behavior and effort-based decision making for rewards. Several lines of evidence suggest that when we make decisions about how much effort we might invest to initiate actions, we weigh up the costs involved against the potential rewards to be obtained. Functional imaging in healthy people reveals both medial frontal and ventral striatal involvement when we make such decisions. In patients with

apathy, for example with Parkinson's disease or small vessel cerebrovascular disease, this evaluation is altered. They show blunted sensitivity to rewards and less inclination to invest effort for low rewards. Both these factors can be improved by dopaminergic medication in some cases. These findings support the view that it is possible to provide a mechanistic account of apathy and obtain better understanding of brain systems underpinning normal human motivation to generate actions.

17:00 **The role of the prefrontal cortex in fluid intelligence and reasoning**

Lisa Cipolotti
University College London

Frontal lesions can impair fluid intelligence (Gf) and reasoning skills, arguably two of most defining features of human cognition. Yet our understanding of their relationship with other executive processes and their neuroanatomical basis remains poorly understood. Group and single case studies using frontal executive and Gf tests will be presented. Our results suggest that Gf cannot account for all executive performance and suggest a possible separation in the frontal functions' architecture between processes mainly involved in Gf and those involved in other executive components. We also combined detailed investigations of performance on the Raven's Advanced Progressive Matrices (APM), a Gf test, and two novel reasoning tests (analogical and deductive reasoning, ART and DRT) in two large patient samples, with unilateral focal frontal or posterior lesions, and healthy controls, with fine-grained anatomical mapping. Impaired performance on the APM and ART was confined to frontal patients, more marked on the right. Patients with non-frontal lesions were indistinguishable from controls and showed no modulation by laterality. On the DRT, right but not left frontal patients were significantly impaired relative to posteriors and controls. Non-parametric Bayesian stochastic block models reveal the community graph structure of lesion deficit networks, disentangling functional from confounding pathological distributed effects. They implicated the right middle and inferior frontal gyrus and pre- and post-central gyri. Thus, a right frontal network is critical to the high-level processes involved in aspects of fluid intelligence and reasoning. The APM and our two novel reasoning tests are sensitive markers of right frontal lobe dysfunction.

17:30 **How to measure forgetting**

Sergio Della Sala
University of Edinburgh

Forgetting is an integral part of memory that refers to the lack of availability of memories of lived events or of information previously encountered. It has been studied since 1885, when Hermann Ebbinghaus tested his own memory, noting that he needed less time each day to learn the whole material. Since then, several theories of forgetting have flourished, such as Time Decay and Retroactive Interference. Clinical neuropsychology capitalises on theories from cognitive psychology to develop assessments for brain-damaged individuals. In turn, this exercise consents to test and refine the theoretical models. However, whether amnesic patients forget material at a normal rate once it has been acquired is still debated as the observed rate of forgetting varies according to the adopted method of scoring. Hence, theorizing with data derived from different scoring systems result in different outcomes. Frequently studies in this area assume that the rate of forgetting depends on initial degree of learning. Other studies have shown that the initial level of learning does not necessarily influence the rate of forgetting suggesting that the variables which influence learning do not

necessarily influence forgetting. In this talk, I will share my doubts and my ambivalence about this topic and will express my only certainty, which is that forgetting should not be conceived as the opposite of learning, but should be given the dignity of independent cognitive functions.

Thursday 25th April 2024

09:10 **Post-stroke cognitive trajectories from Oxford Cognitive Screening studies**
Nele Demeyere
University of Oxford

National and international Clinical guidelines in stroke now all include the need to assess cognition, however, there are differing perspectives on how Post Stroke Cognitive Impairment is defined, with silos of research on post-stroke dementia separated from neuropsychological work on prevalence and trajectories of domain-specific cognitive impairments. In this talk, I will cover recent work that has tried to break down these silos and address the complex trajectories of different cognitive profiles, with work from the Oxford Cognitive Screening programme and the recently completed long-term follow up OX-CHRONIC study

09:30 **IC3 - towards a scalable deep cognitive phenotyping of patients with stroke**
Fatemeh Gerenmayeh
Imperial College London

Cognitive difficulties are common after acute stroke persisting in a third. There is a growing need for scalable, cost-effective and yet in-depth assessment of cognitive function in patients that enables longitudinal tracking of recovery and better understanding of predictors of long-term cognitive outcomes. The IC3 (Imperial College Comprehensive assessment for Cerebrovascular disease; https://ic3study.co.uk/) aims to address this gap through implementation of a novel self-administered web-based tool assessing cognition after stroke with the aim of discovering novel brain imaging and blood biomarkers. IC3 provides an in-depth cognitive profiling through 22 tasks spanning both domain-general (e.g. attention) and domain-specific deficits (e.g. memory, language, visual neglect), together with neuropsychiatric questionnaires. Data on normative ranges derived from >7K older adults are presented. Bayesian modelling is used to derive predictions of cognition based on a patient's sex, age, education, testing device, and presence of dyslexia or psychiatric co-morbidities. The test-re-test reliability and validity analyses will be presented.

09:50 **Increasing efficiency of aphasia assessment after stroke**
Ajay Halai
Medical Research Council (MRC) Cognition and Brain Sciences Unit, University of Cambridge

Multi-assessment batteries are necessary for diagnosing and quantifying the multifaceted deficits observed post-stroke. Extensive batteries are thorough but impractically long for clinical settings or large-scale research studies. Clinically-targeted "shallow" batteries superficially cover a wide range of language skills relatively quickly but can struggle to identify mild deficits or quantify the impairment level. We tested 75 chronic left-sided stroke participants with a variety of deficits using extensive aphasia battery. Cross-validation and

principal component analysis revealed a four-factor solution for the extensive and data-reduced batteries, identifying phonology, semantic skills, fluency and executive function in contrast to a two-factor solution using the shallow battery (language severity and cognitive severity). We show that a data-driven battery appears to be an effective way to save time yet retain maintained sensitivity to mild impairment, ability to grade deficits and the underlying component structure observed in post-stroke aphasia.

10:10 **Refining apraxia diagnosis after stroke**

Elisabeth Rounis
Imperial College London

Limb apraxia is a motor cognitive disorder associated with higher degrees of disability after stroke. Apraxia comprises a heterogeneous group of deficits of skilled action involving problems with dexterity, gesturing, imitating, recognising, pantomiming or executing of single- and multi-step object-directed actions. Apraxia is most common following a stroke affecting the left (dominant) hemisphere causing deficits both in ipsi- and contra-lesional limbs. Despite its importance, apraxia is not formally tested in acute stroke settings, due to the requirement of lengthy neuropsychological assessments, which is difficult to deliver and there are few standardised tests allowing for meaningful comparisons between patients. In this talk, we present data in which we have identified core components underlying the disorder using principal component analyses. We have used these to map its neural correlates. In addition, we present evidence that limb apraxia affects independence in daily activities.

13:00 **Attention to attention in aphasia**

Rahel Schumacher
Luzerner Kantonsspital & University of Cambridge

Attention, our ability to detect, select, and react to the abundance of stimuli present in the environment, is fundamental for nearly all our activities. Attentional impairments are a common consequence of brain lesions but most of the patient-related research on attention has focused on patients with right hemisphere lesions and impairments in (visuo)spatial attention allocation. Patients with left hemisphere lesions often have aphasia and are therefore usually excluded from studies on other cognitive functions. This talk presents clinical and experimental findings regarding left hemisphere stroke patients' performance across a range of attentional tasks and discusses the implications for assessment, therapy, and future research.

13:20 **Interaction between lateralised inattention (neglect) and sustained attention**

Alex Leff
University College London

Covering the evidence from interventional trials of patients with hemispatial inattention caused by stroke, I will explore the role that generalised (sustained) attention plays in recovery.

13:40 **Adding task fMRI and decoding to the neuropsychologists' toolkit**

Matthew Lambon Ralph
Medical Research Council (MRC) Cognition and Brain Sciences Unit, University of Cambridge

The long history of neuropsychology and cognitive neurology contains numerous moments where new techniques and methods have been embraced. Each of these has advanced identification, quantification and understanding of the cognitive, computational and neural bases of patients' preserved and impaired skills. The ability to relate patients' behavioural profiles to their brain damage initially relied on post-mortem examination and was revolutionised by the arrival of in vivo neuroimaging. Task-based functional neuroimaging would seem to be a potentially ultimate, unifying tool for neuropsychology in that participants and their brain function are simultaneously assessed whilst completing tasks of interest. This opportunity would seem further enhanced by the rise of advanced neuroimaging analytics, which could revolutionise our understanding not only about where but also how cognitive functions have been altered following brain damage. Despite the dominance of healthy-participant fMRI in cognitive neuroscience and a handful of seminal patient studies, its use in research and clinical neuropsychology remains rare. This talk will present new task-based language fMRI data collected systematically across a consecutively-recruited group of mild post-stroke aphasic patients. The patterns of preserved and changed language function were mapped with both univariate contrasts and task-based decoding analyses. The results included novel observations such as "representational diaschisis" where there are reductions in representational decoding in intact tissue following brain damage. Perhaps most importantly, explicit mechanistic hypotheses about the relationship between patients' changed behavioural performance, brain damage and task functional neuroimaging were derived from an implemented neurocomputational model of normal and aphasic language.

POSTERS

Wednesday

Trauma, Memory, and Dis-order: A Neuropsychoanalytic Review (Withdrawn)

Ali Bagherzanjani & Najmeh Zivdar
University College London

It has been suggested that trauma tears down the binding thread of time and ensnares one into an ever-impending fragment of the past. Freud believed that one's alienation from the present and future reflects a compulsion to repeat, proceeding from instinctual impulses which drive the organism toward inanimateness and death. In psychoanalysis, repetitive compulsions are perceived to be destructive attacks on time. Nevertheless, recent explorations in neuroscience, particularly in spatial cognition, have shed light on how temporal durations correspond to the neuronal oscillations of the hippocampal-entorhinal system. Navigating the mnemonic space is suggested to be a derived function of the brain structures and neural circuits, transmitters, and algorithms involved in navigating the physical space, resting upon a variety of neural computations across different brain regions. Navigation—in the physical or mental sphere—consists of interwoven egocentric (anchored to the position and body movements of the navigator) and allocentric (world-based coordinates anchored to objects and places) representations. Egocentric representations are anchored to the body movements and position (e.g., velocity and direction) and avail themselves of vestibular, proprioceptive, and sensorimotor feedback, whereas allocentric representations, anchored to the coordinates

of the spatial layout of the environment, pertain to cognitive maps the foundations of which are essentially laid by the neural activity of place cells, grid cells, head-direction cells, and border cells. It has been argued that the invasion of mental imagery can be explored via the interplay between spatial representations.
The present study, binding together psychoanalysis and cognitive neuroscience, aims to review and discuss the mnemonic disorders brought about by trauma.

Investigating changes in BOLD signal during median nerve stimulation

I.Farr, M.Houlgreave, M. Ashgar, S.Francis, K.Dyke & S.Jackson
University of Nottingham

Tourette syndrome (TS) is a neurological disorder, characterised by involuntary motor and phonic tics. The mechanism of tic generation is not fully understood but is thought to involve dysfunctional cortico-striatal-thalamo-cortical circuitry and increased motor cortex excitability. It is frequently reported that tics are proceeded by uncomfortable bodily sensations and although many individuals with TS can temporarily suppress tics, this leads to an increase in the unpleasant urge-to-tic. Paralimbic areas including the insula cortex have been associated with urge-to-tic sensations. Median nerve stimulation (MNS) at 10Hz has been proposed as a potential treatment for TS as rhythmic MNS delivered at 100% motor threshold (MT) reduces urge-to-tic and tic frequency. Previous studies have localised BOLD activation during MNS to sensory and motor regions. This study aimed to replicate identification of regions influenced by rhythmic MNS and further contrast effects of sham stimulation and an arrhythmic stimulation pattern. High field (7T) fMRI data was collected from 20 healthy participants during 3-minute blocks. Following a baseline period, 10Hz rhythmic MNS at 100% MT, arrhythmic (mean frequency of 10Hz with jittered delivery) MNS at 100% MT and 10Hz rhythmic MNS at 50% MT (sham) were delivered in pseudorandom order. Preliminary results replicate findings of increased BOLD activation in contralateral primary somatosensory cortex, bilateral secondary somatosensory cortex, and bilateral insula cortex during MNS. Further analysis will use dynamic causal modelling to explore changes in effective connectivity during MNS between key regions implicated in TS. This may guide further research into non-invasive brain stimulation treatments for TS.

Investigating neuronal noise as a mechanism of tic generation

A. Gialopsou, C. Smith, M. Houlgreave, I. Farr & S. Jackson
University of Nottingham

Tourette syndrome (TS) is a neurodevelopmental disorder characterized by chronic involuntary motor and vocal tics. Previous research has suggested the tics could reflect motor noise, resulting in uncertainty of the voluntary movement and the occurrence of tics. This enhanced neuronal noise may reflect the reduced sensorimotor gating and imprecise forward model of action planning, inherent in TS (Münchau et al.,2021; Albin & Mink, 2006). Experimental data has confirmed increased 1/f noise in the TS population during a sensorimotor task (Adelhöfer et al.,2021). Hence, in this study, we aim to quantify the difference in the neuronal noise between TS participants and age and gender-matched controls (HC). We define neuronal noise as the variability of the cortical oscillations during median nerve stimulation (MNS) and the cortical excitability during single-pulse TMS. Data were collected from 19 people diagnosed with TS (10 F, mean age (SD): 30.8 (10.9)) and 19 HC (10 F, mean age (SD): 28.3 (6.7)). The recruitment (IO) curve of single-pulse TMS was recorded by EMG electrodes placed over the first dorsal interosseous muscle. Then, the cortical activation was recorded during the single-pulse MNS, using a 64-channel electroencephalography (EEG) system. The EEG analysis was focused on small time-windows around the well-defined somatosensory evoked potentials (SEP) components; N20 (20ms ± 10, P45 (45ms ± 20), N60 (60ms ± 20), P100 (100ms ± 20) and P260(260ms ± 50). The component analysis revealed an enhanced difference in the SEP and MEP precision between the TS and HC participants, with the former showing greater amplitude differences and amplitude variability for all

the SEP components. Similarly, TMS-induced MEPs had an increased between-subject and across-trial variability for the TS compared to HC participants. This enhanced variability of the TS responses indicates the increased asynchronous neuronal activity, i.e. neuronal noise. Hence, these findings contribute to our understanding of underlying mechanism involved in tic generation in Tourette Syndrome, which could lead to novel interventions aiming to reduce this asynchrony neuronal activity.

The Double Empathy Problem: A Derivation Chain Analysis and Cautionary Note

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Research on the 'Double Empathy Problem' (DEP) is rapidly growing in academic and clinical settings, with >60% yearly increase in scholarly outputs using this term in the past decade. It is especially popular in research on conditions that are characterised by social cognitive difficulties (e.g., autism). We will argue that, whilst research on the DEP has the potential to improve understanding of (a)typical social cognitive processing, it represents a strikingly weak example of a derivation chain in psychological science. The DEP is poorly conceptualised, and we find that it is being conflated with many other constructs (i.e., reflecting the 'jingle-jangle' fallacy). We provide several examples to show how this underlies serious problems with translating theoretical claims into empirical predictions and evidence. Moving forward, we propose that DEP research needs urgent reconsideration, particularly through a better synthesis with the cognitive neuroscience and neuropsychological literature on social interaction. Overall, we argue for a strengthening of the derivation chain pertaining to the DEP, towards more robust research on (a)typical social cognition. Until then, we caution against the translation of DEP research into applied settings.

New Development and Standardization of the Semantic Knowledge Test for Adults (SKT-A)

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Semantic knowledge processing is a vital cognitive function for interpreting auditory, visual, and written stimuli in humans. Dysfunctions in the semantic knowledge system are commonly associated with conditions like stroke, traumatic brain injury, and degenerative brain disorders. The assessment of semantic knowledge is crucial for diagnosing cognitive impairment and planning effective cognitive rehabilitation strategies. While numerous global semantic knowledge tests exist, their adaptability to cultural and temporal differences is imperative. To address this, we developed and standardized a new semantic knowledge test for adults, named SKT-A. The SKT-A comprises 120 items (60 picture, 60 word test) selected from 260 portrayable words across 16 semantic categories. Test items present a target and two examples—semantically related and unrelated—requiring participants to select the related example. Initial item selection involved 70 items in four categories (natural, artifacts, abstract, and whole-part relationship) chosen by an expert committee with a content validity index exceeding 0.70. Standardization involved 325 healthy adults and 32 brain-damaged patients. Statistical analysis included internal consistency assessment, intra- and inter-rater reliabilities using Cronbach's alpha and Pearson's correlation coefficient. Concurrent validity was measured by correlating SKT-A scores with the Pyramids and Palm trees test (P & P). Mean total scores for SKT-A picture and word tests were 58.8 and 59.4, indicating high internal consistency. Post-hoc analysis categorized subjects (20-69 or ≥70, 0-6 years or ≥13 years). Brain-damaged patients scored significantly lower than healthy adults, with high inter- and intra-rater reliabilities. The SKT-A showed a significant positive correlation between its picture version and the P & P test. In conclusion, the SKT-A is a valuable tool for assessing semantic knowledge in brain-damaged patients, facilitating tailored rehabilitation programs based on age and education levels.

Neurotransmitter Deficits and Semantic Impairments in Frontotemporal Dementia

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Semantic cognition, crucial for knowledge processing and application in communication and daily tasks, is vulnerable to impairment, notably evident in conditions such as frontotemporal dementia (FTD). Accounting for a significant proportion of degenerative dementias, FTD encompasses a spectrum of clinical syndromes characterized by progressive degeneration in the frontal and temporal brain regions, pivotal for semantic processing. Recent research underscores the significance of addressing neurotransmitter imbalances, particularly involving glutamate and GABA, in FTD pathology. Despite their distinct pathological features, FTD syndromes exhibit shared deficits in these neurotransmitters, forming the basis of the 'GABA and glutamate hypothesis of FTD'. This study aims to explore this hypothesis by investigating the association between alterations in GABA and glutamate levels and semantic deficits observed in FTD patients. Utilizing non-invasive MR spectroscopy, neurochemical levels, including GABA and glutamate, were measured in the brains of FTD patients, Alzheimer's disease (AD) patients, and healthy controls (HCs). Semantic cognition was assessed alongside general cognitive functions like language, memory, attention, and executive function. Results revealed FTD patients exhibiting significant deficits in language, memory, and executive function compared to both AD patients and HCs. Moreover, FTD patients performed less effectively on semantic tasks than both comparison groups. Importantly, the balance between excitation and inhibition (EIB = glutamate/GABA) was notably decreased in the temporal lobe of FTD patients compared to HCs. These findings demonstrated cognitive impairments in FTD encompassing semantic deficits, alongside reduced EIB in the temporal lobe, providing preliminary support for the GABA and glutamate hypothesis.

Investigating age-related differences in semantic control mechanisms involved in creative thinking

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Current theories on creative thinking believe that creative thought arises from an interaction between bottom-up associative processes and top-down executive control (e.g., Beaty et al., 2014). Associative processes rely on the structure and organization of the semantic representational system, while control processes navigate the flexible access to, and selection of, task-relevant representations. The role of semantic memory in creative thinking has been well studied, but the contribution of specific semantic control processes has not yet been fully uncovered. These semantic control processes could be key to understanding changes in creative thinking as we age. There have been mixed reports on whether creative thinking changes with age, but recent meta-analytic evidence suggests that older and younger people may be equally capable of divergent thinking under certain conditions (Fusi et al., 2021). In parallel, older people have increased knowledge reserves but decreased semantic control and executive abilities (Hoffman, 2018). Is it possible that age-related changes in semantic abilities are related to preserved performance of older adults on creativity tasks? The present study examined the contribution of semantic abilities and domain general executive functioning to creative cognition in groups of younger (18-30) and older adults (60-90). Participants completed an online battery of tasks to test their semantic (Synonyms, Spot the Word, Semantic Control), creative (Alternate Uses Task, the Remote Associates Task) and executive (nBack, Color Word Inference Task, Number Letter Task) skills. We found no age-related differences on tasks of divergent thinking, but the young people outperformed older adults on executive functioning tasks, and older adults had better semantic and convergent thinking abilities. Semantic knowledge and updating was found to contribute to performance on convergent thinking tasks, but only shifting/inhibition abilities seemed to influence divergent thinking. However, group-level models indicated that semantic control abilities seemed more relevant for creativity in the young, rather than old, people. Given

that older and younger adults displayed equivalent divergent thinking abilities, these groups may differentially draw on various cognitive elements to achieve the same outcome. In line with the default-executive coupling hypothesis of aging (DECHA; Spreng & Turner, 2015), we suggest that while younger adults may be relying on their semantic control systems to create novel connections between distant concepts, but older adults may be drawing upon their already existing, preserved stores of conceptual knowledge.

Reduced memory test performance by people with subjective cognitive decline: A systematic review and meta-analysis

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Subjective cognitive decline (SCD) was operationalised for research purposes as the self-experience of cognitive decline without objective impairment on standardized tests used to detect mild cognitive impairment or dementia (Jessen et al. 2014). Despite this, some research suggests that people with SCD may show subtle impairment on more detailed neuropsychological assessment compared to people without SCD. The present review investigated whether there are group differences in performance on detailed memory assessments between people with and without SCD. We conducted a systematic search of the literature using multiple electronic databases (PsycINFO, Web of Science, MEDLINE, CINAHL, and PubMed) to identify all studies reporting memory task performance by people with SCD since 2014 (to ensure inclusion of studies whereby SCD was defined in accordance with the Jessen et al. criteria). A total of 1,815 records were identified, of which 45 met inclusion criteria and were included in a random-effects meta-analysis. Results indicated a significant difference in memory test performance, in the direction of poorer performance by people with SCD than people without SCD. There was significant between-study heterogeneity. These results suggest that detailed cognitive assessment may be sensitive to SCD. SCD may represent the emergence of objective memory decline due to neurodegeneration.

Functional mapping of facial movements in Tourette Syndrome

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Key mechanisms implicated in the mediation of cortical activity and cortical representations are surround inhibition and the inhibitory neurotransmitter γ-aminobutyric acid (GABA). Evidence from Focal Hand Dystonia, a movement disorder characterised by involuntary muscle contractions in the hands and arms, has supported this link with evidence of impaired sensorimotor GABAergic inhibition and abnormal and disorganised cortical mapping of the hand and digits. Similarly, Tourette Syndrome (TS) is a movement disorder also characterised by altered inhibition. However, it is unclear if functional mapping of body parts involved in tics, such as different facial regions, are affected in TS. This study aimed to use fMRI to investigate the functional representations of different facial movements in the sensorimotor cortices of those with TS and in healthy controls (HC). To do this, three fMRI task blocks were acquired with participants visually instructed to perform a facial movement at 1Hz. Each task block consisted of a different facial movement; blinking, grimacing, and jaw clenching. These movements are very common tics experienced by those with TS. Significant cluster activations were identified across the bilateral SMA and pre- and post-central gyri for blink, grimace, and jaw clench blocks in both the HC and TS groups. However, these clusters did not significantly differ between groups suggesting similar activations within the bilateral SMA and pre- and post-central gyri across groups. This data suggests that functional mapping of facial movements (blinking, grimacing and jaw clenching) are not altered in TS.

Error Responses and Patterns on the 12-item Face-Name Associative Memory Exam (FNAME-12)

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The inability to recall names and associated information of familiar individuals is a common early symptom of Alzheimer's disease. Analysing error patterns on cognitive assessments offers valuable insights into the cognitive processes underlying incorrect responses. The 12-item Face-Name Associative Memory Exam (FNAME-12) is designed to detect subtle memory impairments in the early stages of Alzheimer's disease. This study utilised data from Phase 3 of Insight 46, a neuroimaging sub-study within the MRC National Survey of Health and Development. During the data freeze, participants (n = 191, 48.69% female) completed the FNAME-12, which required them to learn 12 faces (6 female; including younger and older-looking faces) along with corresponding names and occupations. Recall of names and occupations was tested across five trials, with errors categorised into three types: no response, substitutions (a non-target name or occupation from another set stimulus) and intrusions (an unfeatured name or occupation in the set). Frequency of the different error types were explored. Preliminary examination of trials 1-4 indicated a tendency for substituting names and occupations, particularly between faces of the same gender and age group. Notably, young women's names were frequently interchanged, as were young men's names. A higher frequency of occupation substitutions was observed for women's faces than men, suggesting potential biases in associative memory recall related to age and gender. Serial-position effects, variability in error responses on the 7-day delay trial and intrusion patterns will be explored before the conference. The identified error patterns, particularly the propensity for age and gender-related substitutions, shed light on potential biases in associative memory processes. Understanding the nuances of error responses in associative memory tasks may contribute to improved early detection and monitoring of cognitive changes associated with Alzheimer's disease. Further research will investigate error responses in relation to biological and cognitive markers of early cognitive decline.

"The radiant Quiet. The nourishing Quiet, The illuminating Quiet": an Analysis of Autobiographical Accounts of Inner Speech in Aphasia

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Inner speech in aphasia is a rapidly expanding research area, but the concept of inner speech can be defined in numerous ways. It is an inherently subjective experience, so first-hand accounts provide an ideal data source to explore the range of ways in which it can be affected in aphasia. This research explores the subjective descriptions of inner speech provided by authors with aphasia and interprets the findings in relation to the inner speech literature. To do so we carried out a metaphor-led discourse analysis of descriptions of inner speech in four autobiographical accounts of aphasia. Metaphorical expressions describing language processing were identified and coded, then systematic metaphors (i.e., the related concepts which are used consistently to describe a particular topic) were described. The metaphors used to describe inner speech were then analysed, with attention to patterns of use and contextual information. Two types of inner speech — Phonological Inner Speech and Dialogic Inner Speech — were described as distinct and dissociable experiences, and were described using different metaphors. Two authors described impaired dialogic IS, using INNER DIALOGUE AS INNER VOICES/PERSONS/MONOLOGUE/DIALOGUE and APHASIA AS SILENCE/ FLUID/ SPIRITUAL EXPERIENCE. Two other authors described impaired phonological IS using WORDS AS OBJECTS, MIND AS CONTAINER and INNER SPEECH AS HEARING WORDS. A double dissociation of these different concepts of inner speech was seen across two accounts. Different impacts on language processing and cognition were also described by the authors. Recent studies on inner speech in aphasia have

focused on phonological IS, but in these accounts only impaired dialogic IS was described explicitly as a 'lack of inner voices'. This research demonstrates that subjective accounts of inner speech can help clarify theoretical discussions and clinical implications.

Cultural adaptations in Cognitive Stimulation Therapy for mild-moderate Dementia: A Narrative Review

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Cognitive Stimulation Therapy (CST) is an evidence-based psychosocial intervention recommended by the National Institute for Health and Care Excellence (NICE) guidelines. Through the implementation of structured and targeted activities, CST aims to mentally stimulate individuals with a diagnosis of mild to moderate dementia and improve their quality of life. This review aims to examine how cultural adaptations and innovations within the CST protocol may impact on the efficacy of the intervention. To capture how changes in demands and resources amid a pandemic can influence the outcome of interventions, literature pre-2020 was excluded from this review. In our search, we focused on adaptations in language, the content of the activities and the mode of delivery (e.g., virtual CST [VCST] and in-person CST). Limitations around access to therapy as well as familiarity with technology appeared to influence the outcome of the intervention in different cultures. Also, when considering cultural adaptations, an important consideration related to the feasibility of some adaptations such as changing the topic of the session to a more meaningful one to a community, which links to the generalisability of the changes. Despite the challenges, we found that CST continues to be a popular intervention with low attrition rates within various cultures following adaptations. In-person and VCST appeared to have similar positive outcomes for patients who had been exposed to both delivery modes. Further research is however needed to compare the effectiveness of these intervention in CST novices. In conclusion, CST continues to be a beneficial intervention for patients with mild-moderate dementia. More studies looking at the impact of cultural adaptations on CST efficacy are needed. Clinicians should be aware of the trade-off between targeting and appealing to the individuals taking part in the intervention and delivering evidence-based practice, in an effort to help develop culturally-appropriate protocols that are effective.

Mapping brain-behaviour relationships: insights from two fMRI tasks

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Neuropsychological research focuses on the relationship between brain and behavioural deficits. We employ various methods and tools to measure both behaviour and neural activity, with an underlying assumption that there is a link between the two that researchers aim to discover. More specifically, in fMRI studies, we assume that behavioural measurements inside the scanner are a proxy of behaviour we observe in typical lab/naturalistic settings, in addition to the fact that neural activity is related to the behaviour. These assumptions are seldom empirically validated. The matter is further complicated when attempting to explain both healthy and clinical populations, as the degree to which the relationship between brain and behaviour may change. In this study, we formally tested three relationships between brain and behaviour: (a) in-scanner and out-of-scanner behaviour, (b) in-scanner behaviour and BOLD activation and (c) out-of-scanner behaviour and BOLD activation; with the hypotheses that a relationship should be observed for all comparisons. We obtained deep phenotyping of behavioural deficits from post-stroke aphasia patients (N=24) and healthy participants (N=30), while also employing two fMRI tasks: repetition and pattern-matching task.

The results revealed a close mapping of the in-scanner and out-of-scanner behaviour in both tasks. While the observed neural activation across groups and tasks involved the anticipated regions, the results of the brain-behaviour analyses were largely inconsistent: we did not identify consistent linear relationships between in-scanner and out-of-scanner behaviour and the expected neural correlates for both tasks. The results highlight the nuanced nature of the mapping between behaviour and the BOLD signal, by emphasising the crucial step of verifying the expected in-scanner-brain relationship before extrapolating to out-of-scanner behaviour. Our findings also underscore the necessity of a thorough background neuropsychological assessment, as well as carefully selected fMRI tasks, especially when studies involve clinical populations.

Thursday

Investigating the Effects of Stroke Infarct: Comparisons between Simulated and Real Lesions and Understanding Post-Stroke Semantic Impairment in Gradient Space

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Stroke causes massive functional connectivity changes in extensively distributed brain regions beyond the lesion location. Connectivity gradients might effectively capture functional connectivity disruptions caused by infarcts, both locally and remotely from the lesion location. Serving as a comprehensive framework, they capture a wide variance in functional connectivity, potentially providing a better understanding of the brain's functional architecture and its associations with cognitive functions. Here, i) we investigated the impact of stroke infarcts by comparing real lesions with simulated lesions in gradient space (n =8) and ii) characterised the simulated effects of stroke on connectivity gradients and related the changes to semantic and executive functions (n =20). We extracted gradients from functional connectivity matrices of participants with semantic aphasia, selected to have difficulty controlling semantic cognition, and simulated the effects of lesions on connectivity matrices as well as measuring changes in intrinsic connectivity with resting-state fMRI. Furthermore, we examined the associations between simulated gradient changes and semantic and executive functions. Left frontal orbital cortex showed a shift towards default mode network (DMN) on Gradient 3 in participants with poorer semantic performance. This gradient captures the separation between (DMN) and control networks. We also found that simulated gradient changes were more similar to real gradient changes for Gradient 3 than for other dimensions of functional organisation. We propose that the gradient decomposition approach may be useful in detecting changes in intrinsic connectivity patterns after stroke and predicting recovery from post-stroke semantic impairment, although further work is needed in larger cohorts.

The outcomes of group intervention for numerical deficits after a stroke/ brain-injury (acalculia), based on the principles of embodied cognition

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Acalculia is an acquired deficit in numerical skills affecting 30-65% of stroke/brain injury survivors. The condition negatively impacts independence (e.g. traveling, managing money, counting medications) and wellbeing. Despite the availability of several assessments, acalculia is not routinely screened for, and treatment of the condition often falls outside the scope of the professionals involved in the recovery process (speech and language therapy, occupational therapy, neuropsychology, etc.), meaning it often remains untreated, even

when patients request support for their number-processing problems. A recent systematic review identified only 16 English-language published interventions for acalculia, with a total of N=31 patients. These interventions were all delivered individually (i.e., none utilised group settings), most were tailored to individual patients' deficits (e.g., specific multiplication facts), and interventions largely relied on old-fashioned 'drill' strategies. We will present a mixed-methods study that examined the feasibility of a group-setting acalculia intervention, designed using the principles of embodied-cognition (i.e., combining congruent physical engagement with cognitive concepts). Patients (N=4) took part in six-weekly 45-minute group sessions involving playful activities with numbers designed to encourage congruent movements. Following a 4-week break, N=3 took part in three further sessions. Performance data for number skills (theoretical and functional) were collected before the intervention (T0), after six weeks (T1) and after further three weeks (T2). Qualitative data were collected 3-months post intervention using semi-structured interviews with two patients. Substantial improvements were observed on all measures at both T1 and T2. Qualitative findings emphasized the importance of group-settings, and the impact of playful learning on cognition, engagement, and wellbeing. We conclude that playful group therapy integrating modern educational theories is feasible and provide early efficacy data showing improved numerical skills and wellbeing. Future work should evaluate the impact of combining movement and cognitive rehabilitation to improve patients' outcomes.

The Development and Validation of an Automated Method to Quantify Cortical Atrophy in Acute Post-Stroke CT Scans

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Post-stroke cognitive impairment (PSCI) is a common yet debilitating consequence of stroke. Prior studies have linked cortical atrophy, as assessed on diagnostic CT scans, to PSCI prognosis. Cortical atrophy is typically evaluated through visual ratings, which are time-consuming and prone to variability. Our study aimed to develop and validate a robust automated method to quantify cortical atrophy in acute post-stroke CT scans. The new method extracts volume measurements of cerebrospinal fluid (CSF) directly from the scans and normalizes by intracranial volume (CSFn). Ground truth cortical atrophy was visually assessed using the Global Cortical Atrophy (GCA) scale. We calculated the Spearman correlation between CSFn and total GCA, and predicted total GCA based on CSFn. Using two multivariable linear regression models, we related both estimated and actual GCA to global PSCI (proportion impaired Oxford Cognitive Screen tasks) 6 months post-stroke, with age, sex, education, NIHSS, lesion volume, recurrent stroke, scan-assessment interval, and white matter lesions presence as covariates. We compared the models' predictions using a paired-samples t-test. Preliminary results in our dataset of 371 participants (M/SD age = 73.68/12.47; 173 female; 318 ischemic stroke; 97 recurrent stroke) show that there is a strong correlation between CSFn and total GCA ($r(369)=0.77$, $p<.001$). A linear regression to predict total GCA revealed that CSFn is a significant predictor ($B=1.81$, $p<.001$, 95% CI [1.56;2.07]) after adjusting for age ($R2=0.65$, $MAE=4.10$). In the linear model to predict PSCI, estimated GCA was a significant predictor ($B=0.01$, $p=0.008$, 95% CI [0.00;0.01]). The model's predictions were not significantly different from those made by the model using actual GCA ($t(370)=-0.34$, $p=0.74$), confirming that the models are comparable.
These findings highlight that our method is a potentially valuable alternative for the GCA scores obtained through visual ratings and further establishes the prognostic utility of acute CT neuroimaging markers for post-stroke cognitive outcomes.

The Prevalence and Impact of Health Anxiety Following Subarachnoid Haemorrhage: A Cross-Sectional Study

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Although health anxiety is common across patient populations, there is currently no available data on the prevalence of health anxiety following subarachnoid haemorrhage (SAH). This study aimed to 1) estimate the prevalence of health anxiety after SAH; 2) investigate potential associations between health anxiety and psychosocial outcomes in this context; and 3) compare health anxiety and psychosocial outcomes between individuals with aneurysmal and non-aneurysmal SAH. Seventy-one participants (mean age: 63; 25% male; 72% with aneurysmal SAH) were recruited from a UK National Health Service outpatient screening and intervention pathway. Assessments were conducted at six weeks (25%), five months (35%), and 11 months post- SAH (40%). We measured health anxiety with the Health Anxiety Inventory-18 (HAI-18). Using other self-report psychometric scales, we measured psychological distress, functional impact, health-related quality of life (HRQoL), headache burden, and fatigue. 28% of participants scored above the HAI-18 cut-off (>18) for high health anxiety. Only HRQoL and psychological distress significantly explained variations in health anxiety in a regression model. A two-way ANOVA found no significant impact of SAH type (aneurysmal or non-aneurysmal) or time since discharge on health anxiety. Furthermore, a one-way MANOVA indicated no significant differences in psychosocial outcomes between individuals with aneurysmal and non-aneurysmal SAH. This study offers initial evidence that clinically significant health anxiety is present in more than a quarter of SAH survivors. Our preliminary observations indicate an association of health anxiety with diminished HRQoL and increased psychological distress. While preliminary, our findings suggest health anxiety is present in both aneurysmal and non-aneurysmal SAH survivors. Based on these findings, we recommend screening survivors at least one-year after SAH to identify potential health anxiety, which may be currently overlooked and under-treated in clinical practice.

Factors Affecting the Assessment of Cognitive Impairment in Stroke: Perspectives, Challenges, and Future Directions

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Alongside the physical sequelae of stroke, cognitive impairment presents in approximately 50% of individuals at 6-months post-stroke, and poses a considerable threat to activities of daily living and quality of life of stroke survivors. Valid and sensitive cognitive assessment, with reliable interpretation, is vital to identify and differentiate precise cognitive deficits, with potential translational value for informing prognosis and clinical care. However, several issues afflict neuropsychological measurement that are not often acknowledged. The aim of this exploratory research working group is to bridge the expertise across research groups to appraise the factors that influence performance on, and associated interpretation of, standardised cognitive assessments used in stroke. This research working group brings together multidisciplinary expertise from five leading Irish and UK academic institutions. To date, there have been multiple collaborative activities including two international research group visits and multiple ongoing discussion forums to discuss the challenges surrounding the use of domain-specific cognitive function and global screening tools in stroke research and clinical practice. Potential confounding or challenging factors include, but are not limited to, attentional temporal fluctuations (e.g. time-on-task deteriorations, fatigue, sustained attention deficits), dispositional factors (e.g., motivation losses, anxiety, depression), stroke-related disability (e.g., aphasia, visual neglect), and resource considerations (e.g., patient burden, administration by trained neuropsychologists). These factors, and others, render it challenging

to delineate cognitive aberrations from noise. As such, alongside describing key challenges, this research working group will also offer evidence-based and/or expert-led recommendations and pathways to improve the validity of cognitive screening and assessment. We will provide information regarding the appropriateness of different measures or adaptation needs for different populations, or suggest statistical ways to account for moderating variables. This collaborative engagement will thus provide important information that may have a translational impact by informing decision-making in research and clinical practice.

The neuroanatomical correlates of semantic knowledge processing in patients with ischemic stroke

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Semantic knowledge is a component of declarative memory that refers to knowledge about the world around oneself (Purves et al., 2008). Many cases of semantic impairment are associated with brain damage including degenerative disease, traumatic brain injury and stroke. Semantic impairment could result from the regions damaged by stroke such as the damage to the semantic network consisting of the frontal, temporal and parietal. The main purpose of this study was to investigate the relationship between brain lesions and semantic knowledge processing in patients with ischemic stroke. A total of 54 patients with unilateral ischemic stroke participated in the study. Semantic knowledge was assessed using the Semantic Knowledge Test for Adults (SKT-A) consisting of 60 items with word (SKT-A-w) and picture (SKT-A-p) versions. All MR images were acquired on a 3.0T Siemens Prisma scanner (Siemens, Erlangen, Germany) at Korea University Anam Hospital. We manually identified the lesion of each patient on the b0 image, the first volume of DTI, using ITK-SNAP. The lesion binary images were coregistered to individual T1 and normalized using SPM12 implemented in MATLAB. Statistical analysis was conducted using the Statistical NonParametric Mapping (SnPM) 13 toolbox. The range of patients' ages was from 29 to 86 years old, and the average was 62.80 ± 14.19. The mean scores of SKT-p and SKT-w were 51.63 and 51.85, respectively. VLSM results showed that the left temporo-parieto-occipital junction was associated with the scores of SKT-A-p and SKT-A-w. This cluster included the posterior middle temporal gyrus (MTG), inferior parietal lobule (IPL) and occipital lobe. Only the left posterior part of the brain corresponded to a part of the ventral pathway that showed significant correlation to semantic processing. In conclusion, the results suggested that human semantic processing may be engaged in the ventral pathway.

StrokeCog-R: A protocol of a pilot randomized controlled trial of a novel cognitive rehabilitation programme for stroke survivors and their family members

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Approximately 50% of patients who have experienced a stroke will also present with post-stroke cognitive impairment (PSCI). PSCI is associated with increased emotional distress, physical disability and reduced quality of life. Despite the frequency of PSCI and their consequences to patients, the efficacy of cognitive interventions for this cohort is not well established. The primary aim of this feasibility trial is to collect patient recruitment and attrition rates, and to calculate the statistical power necessary to inform the development of a definitive trial. Testing the efficacy and acceptability of the StrokeCog cognitive intervention for people with mild to moderate PSCI and their family members is a secondary aim of this study. Sixty-four patients screened for mild to moderate PSCI will be consecutively recruited. Following baseline neuropsychological assessment, participants will be randomized into intervention and control (usual care) groups. The intervention consists of five weeks of group-based rehabilitation including tailored home activities, administered by a clinical

neuropsychologist and research assistants. The primary intervention outcome is cognitive function as measured by a neuropsychological battery administered before and immediately after the intervention and at four months post-intervention. A focus group at the end of each intervention will document intervention acceptability. Other secondary outcome measures including patient self-efficacy and caregiver wellbeing will be captured through validated questionnaires administered to all participants. Recruitment and attrition rates will be documented during the recruitment phase of the trial. The effectiveness of different communication techniques for retaining participants between the intervention period and the four-month follow up will also be tested. These data will be used to estimate recruitment efforts, and necessary effect sizes to power a definitive trial. This study will inform a definitive trial which has the potential to make a substantial contribution to the evidence base for cognitive rehabilitation in stroke.

Predictors of Poor Post-operative Cognitive Outcomes in Adult Temporal Lobe Epilepsy: The 'Red Flags' Initiative

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Post-operative cognitive ability following epilepsy surgery depends on the complex interplay of the functions destroyed, compromised, released and unaffected by the resection. Several clinical, demographic and neuropsychological factors serve as biomarkers for these processes, and have been utilized in predictive models to estimate the individual risk of post-operative cognitive decline. These predictions can provide a rational basis for the pre-operative counselling and 'pre-habilitation' of prospective surgical candidates. However, not only are these predictive models highly heterogenous with respect to their choice of predictors, but they often require the input of scores on specific tests normed on English speaking samples from the USA or UK, which limits their utility. The 'red flags' initiative is a project designed to overcome these limitations. We performed a systematic search of the cognitive outcome literature in adult temporal lobe epilepsy surgery using PubMed, Embase and APA PsychInfo databases yielded 2667 articles. Out of these, 120 studies met the final eligibility criteria. Data pertaining to sample characteristics, neuropsychological domains and tests, statistical approaches, predictor- and outcome variables were extracted from included studies. Significant predictors included age, etiology, side of surgery, good pre-operative function, and neurophysiological and neuroradiological characteristics. These predictors were then combined into an exploratory qualitative model and weighted on the basis of 1) frequency with which they appeared in the literature 2) sample size and multi-center replicability of individual studies 3) quality of evidence and methodological rigor. Intact pre-operative cognitive function emerged as the strongest 'red flag' of poor post-operative outcome. The 'red flags' initiative is aimed to provide clinicians with a practical and patient-friendly tool to characterize and communicate the individual risks of post-operative cognitive decline. It improves upon existing predictive models by systematically analyzing cognitive outcome literature across multiple centers, languages and testing paradigms to produce a model with universal applicability.

A scoping review of research investigating patient and carer information needs around post-stroke cognition

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Post-stroke cognitive impairment is prevalent. While there is no strong evidence to support interventions that improve cognitive outcomes directly, psychoeducation may be beneficial. This review set out to search the literature systematically to map and identify gaps in research investigating patient and family member psychoeducation needs regarding post-stroke cognition.

Scoping review conducted in line with Joanna Briggs Institute (JBI) recommendations and PRISMA-ScR checklist. MEDLINE, PsycINFO, Embase, CINAHL and Scopus were searched for peer-reviewed studies which were conducted in a high-income country, describing cognition-related psychoeducation needs in stroke survivors and/or family members aged ≥18 years (≥50% of the study population). Two reviewers independently screened titles, abstracts, then full text articles. One reviewer extracted pre-defined data. Data were verified by a second reviewer. Synthesis involved descriptive statistics and a pragmatic thematic analysis. Searches identified 8,115 articles (including hand searching), of which 30 were included. Articles were published between 1996-2023. Studies were conducted in Australia (n=7), USA (n=6), UK (n=5), Canada (n=3), New Zealand (n=3), Ireland (n=2), Netherlands (n=2), South Korea (n=1) Sweden (n=1). Most studies (n=21) used an exclusively qualitative approach but 6 combined qualitative/quantitative methods. The post-stroke period under investigation varied, including the acute/subacute stage (n=10) and the chronic stage (n=3), though many did not explicitly state the timepoints. Articles included research with stroke survivors only (n=7), family members only (n=12) and both stroke survivors/family members (n=11). Qualitative analysis suggested participants wanted psychoeducation about cognitive impairment, including recovery expectations, treatment/therapy options, and pointers to the services/resources available. Hopeful information was important. Factors impacting cognition-related psychoeducation needs were identified as time since stroke and family member relationship. Most articles focused on aphasia with very few studies considering other cognitive domains (e.g., memory, attention, executive function).
The need for psychoeducation regarding cognition is well evidenced throughout the post-stroke care continuum though most research has focused on language impairments. Further research investigating other cognitive impairments (e.g., memory, attention, executive function impairments) is required.

Neurocognitive Correlates of Cerebrovascular Small Vessel Disease (SVD): Implications for Decision-Making (DM) Under Uncertainty

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Cerebrovascular small vessel disease (SVD) represents a burgeoning area of investigation in neurocognitive research, particularly as it pertains to its intricate influence on decision-making (DM) processes under conditions of uncertainty. This study seeks to elucidate the neurobiological underpinnings linking SVD pathology to alterations in DM, with specific emphasis on neural substrates implicated in the processing of uncertainty. Our investigation aims to delineate both structural and functional changes within the neural circuitry associated with SVD-related cognitive decline. To accomplish this, we employ functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI). Such neuroimaging assessments afford a nuanced understanding of the impact of vascular pathology on specific brain regions implicated in DM under uncertainty. A recently developed behavioural paradigm consisting of both active sampling and passive choice tasks that rigorously evaluate DM under conditions of uncertainty was used to complement our neuroimaging endeavours. A cohort of over 30 SVD patients and age-matched healthy controls were subjected to complete these DM tasks, allowing for the quantification and observation of the influence of vascular pathology on key aspects such as uncertainty perception, risk aversion, and adaptive decisional strategies.
Furthermore, this research seeks to unravel potential moderating variables, including cognition, apathy, motivation, impulsivity, anxiety, and depression, contributing to the observed heterogeneity in cognitive profiles among individuals affected by SVD. The integration of clinical, neuroimaging, and behavioural datasets affords a comprehensive understanding of the nuanced interplay between SVD and DM under uncertainty.
This research holds promise for advancing the scientific understanding of SVD-related cognitive impairments. By bridging the translational gap, our findings aspire to inform the development of targeted interventions. Our scholarly endeavours also serve to delineate specific white matter (WM) tracts implicated in the process of DM under uncertainty. Thus, we hope to generate a clearer picture of the human cerebral cartograph.

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A CALL FOR SYMPOSIA IS NOW OPEN (*Deadline: 15th June 2024*)
If you'd like to organise a symposium, please email Richard Binney (r.binney@bangor.ac.uk), with a description of the aims and content, and the names of 3 speakers who have provisionally agreed to contribute.

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