

DAY 1: PRESENTATIONS

SYMPOSIUM: The challenge of early diagnosis of Alzheimer's disease and other dementias: neuroimaging and neuropsychological strategies

The management of dementia is now acknowledged as one of the greatest challenges for health services worldwide. As understanding of the pathobiology of the underlying diseases causing dementia deepens there is increasing optimism that drugs with disease-modifying potential may soon become available. As a consequence, the identification of these diseases in their earliest stages is of increasing importance; not only does earlier diagnosis facilitate patient care but future disease-modifying treatments are likely to be most beneficial if applied early in the disease process when the potential to maintain brain viability is greatest.

At present there is no consensus opinion about the optimal diagnostic strategy; tests used in the diagnosis of established dementia lack sensitivity in earlier stages of disease. As the search for reliable biomarkers of early dementia intensifies, much attention is focused on neuroimaging and neuropsychological approaches. The field of neuroimaging has witnessed a number of significant advances; the development of automated techniques for analysing grey and white matter integrity, the use of functional MRI to detect early changes in brain activation, and the advent of ligand-based PET imaging with the ability to detect *in vivo* the amyloid plaques associated with Alzheimer's disease. The role of neuropsychological assessment in diagnosis of dementia is also changing; not only is there a greater emphasis on identifying the earliest cognitive changes in AD and other dementias but test methodology is evolving, as exemplified by the application of tests of spatial cognition, virtual reality-based paradigms as well as "ecologically valid" tests designed to reflect real-life situations more closely than traditional pen-and-paper tasks.

This symposium brings together a panel of internationally-recognised leaders to discuss the strategies being adopted to meet the challenge of early diagnosis of dementia.

Neuropsychological Correlates of Awareness of Memory Dysfunction in Early-stage Alzheimer's disease and vascular dementia

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Objectives: The association between neuropsychological impairments and loss of awareness of neuropsychological in early-stage dementia was explored with reference to the CAM model.

Methods: Awareness of memory impairment was investigated in 40 patients Alzheimer's disease (AD) and 35 patients with vascular dementia (VaD). A comparison was made between the Objective Judgement Discrepancy (OJD) Subjective Rating Discrepancy (SRD) methods to measure awareness and the relationship with executive function, memory, language and semantic memory.

Results: The AD and VaD groups showed similar levels of loss of awareness for memory impairment for the OJD and SRD measures. Regression analyses supported for both groups an association between memory deficit and the OJD measure and between naming impairment and the SRD measures.

Conclusions: Loss of awareness of memory dysfunction in dementia may vary according to the type awareness measured with deficits in episodic and semantic memory as main contributing factors.

Are saccadic eye movements a potential biological marker for Alzheimer's disease?

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Objectives: Patients with Alzheimer's disease (AD) present a formidable challenge for neuropsychological research. The psychological complications of the disease can make it difficult to distinguish generic impairment of the mind from the secondary effects of the disorder. We report on measures of saccadic eye movements that: (1) distinguish between age and disease effects (2) are sensitive to severity of dementia and (3) are sensitive to the longitudinal degeneration in AD.

Methods: Participants comprised patients with Parkinson's disease (PD), Alzheimer's disease (AD), healthy elderly controls (EC) and young controls (YC). Participants completed a series of pro-saccade and inhibitory saccade tasks (ISTs) that varied in difficulty (No-Go, Antisaccade & Go/No-Go) and a battery of neuropsychological assessments (see Crawford et al, 2005).

Results: Examination of saccades in all ISTs revealed that AD patients' errors were significantly increased in proportion to task difficulty compared to those of the PD, YC and EC groups. Uncorrected inhibitory errors for the AD group on the antisaccade task were significantly greater than those of the PD, EC and

YC groups. PD patients errors were significantly greater compared to those of both YC and EC groups. However, in contrast to the AD, PD patients were able to correct a greater proportion of their inhibition errors. The frequency of these errors was positively correlated with dementia severity in AD and gradually increased at follow-up assessments over 18 months.

Conclusion: The principle abnormality in Alzheimer's disease was a striking increase in inhibitory errors, together with a marked reduction in corrective eye movements after the eye had moved inadvertently towards the target. The Alzheimer's disease patients revealed a 10-fold increase in the proportion of anti uncorrected errors in comparison to healthy participants and patients with PD. Assessment of inhibitory control of saccadic eye movements may provide a promising biological marker for Alzheimer's disease.

Reference: Crawford, T.J., et al (2005). Inhibitory Control of Saccadic Eye Movements and Cognitive Impairment in Alzheimer's Disease *Biological Psychiatry*, **57**, 1052-1060.

Effect of white fish consumption on cognitive function in the elderly.

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Objectives: This study investigates correlations between white fish consumption and cognitive function in a group of over-65s. Existing literature suggests beneficial effects of total fish on cognition in this group e.g. Nurk et al., (2007). However there are fewer studies focusing on just white fish. White fish is high in B vitamins, selenium and omega-3 polyunsaturated fatty acids, particularly docosahexaenoic acid (DHA). DHA is critical for brain function as it is involved in maintaining synapses, promoting expression of brain derived neurotrophic factor (BDNF), inhibiting pro-apoptotic enzymes and it directly inhibits amyloid beta secretion. These mechanisms are all involved in dementia.

Methods: Thirty participants took part (mean age 74.2) in the study. A questionnaire was created to assess participant's fish intake. Neuropsychological assessment was composed of a word recall task, digit span, the Stroop test, a spatial associative learning test and an MMSE.

Results: Significant positive correlations were obtained between white fish intake and participant's MMSE and word recall score. Total fish consumption positively correlated with the Stroop test but no significant correlations were found for oily fish consumption and any of the tests.

Conclusions: The project identified novel findings associating white fish intake with greater cognitive performance on word recall and the MMSE, a widely used diagnostic tool. These findings have significant implications for cognition in the elderly, and research into diet and dementia.

DAY 2: PRESENTATIONS

Brain imaging evidence for compensatory neural re-organisation in Tourette syndrome

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Objectives: Children with neurological disorders may follow unique developmental trajectories, whereby they undergo compensatory, neuroplastic, changes in brain structure and function that help them gain control over their symptoms. We used behavioural and brain imaging techniques to investigate this conjecture in children with Tourette syndrome [TS] and a group of typically developing children.

Methods: We used a manual response-conflict task that induces high levels of inter-manual conflict to investigate cognitive control of motor output. We correlated performance on this task with structural (diffusion-weighted imaging - DWI) and functional (fMRI BOLD) brain imaging measures.

Results: First, we show that individuals with TS exhibit enhanced control of motor output relative to age- and gender-matched controls. Second, using structural (DWI) brain imaging techniques, we demonstrate widespread differences in the white-matter (WM) microstructure of the TS brain that include alterations in the corpus callosum [CC] and forceps minor [FM] that significantly predict tic severity in TS. Most importantly, however, we show that task performance for the TS group (but not for controls) is strongly predicted by the WM microstructure of the FM pathways that lead to the prefrontal cortex, and by the fMRI BOLD response in prefrontal areas connected by these tracts.

Conclusions: These results provide compelling evidence for a compensatory, neuroplastic, brain re-organisation that may underlie the increased self-regulation mechanisms that have been hypothesised to bring about the control of tics during adolescence.

Tool use and the left hemisphere: what is lost in apraxia?

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Objectives: Apraxia after left fronto-parietal damage is widely interpreted as evidence of damage to representations of familiar actions, but an alternative view is that there is impaired planning or control of hand-tool postural relationships. We compared reaching for familiar tools with reaching for abstract objects with the prediction that both would be equally impaired by this postural deficit.

Methods: Patients with unilateral lesions and age-matched controls reached rapidly for inverted tools or for abstract objects under conditions which required rapid inversion of the hand during reaching, either to avoid a barrier or to carry out a future action with them.

Results: Apraxic patients frequently failed to invert the hand to grasp inverted tools by the handle or did so abnormally slowly, whereas inversion of the hand when reaching for abstract objects was largely unimpaired. Frequency of errors in tool grasping correlated with severity of apraxia.

Conclusions: This selective impairment in grasping tools for use is consistent with the theory of damaged action representations, but evidence from elsewhere suggests that these are cognitive representations of hand-tool interaction, not visuomotor engrams as the classical theory of apraxia suggests.

Motor imagery efficacy in stroke recovery

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Background: There is evidence to suggest that mental rehearsal of movement can produce effects normally attributed to practising the actual movements. This efficacy is generally attributed to modulation of neural circuits, where motor imagery would induce the same plastic changes in the motor system as those following repeated physical practice. In stroke rehabilitation such proposed mechanisms would also be in line with the principle of 'guided recovery' (Robertson and Murre 1999) proposing that lesioned circuits can be 'rescued' by activating the specific circuits through precise targeted bottom-up and top-down inputs.

Objectives: This randomised controlled trial evaluated the therapeutic benefit of motor imagery in stroke patients with persistent upper limb motor weakness. Current efficacy evidence for mental practice with motor imagery in stroke is insufficient due to methodological limitations.

Method: 121 Stroke patients with a residual upper limb weakness within six months following stroke were recruited. The study analysed the outcome of 39 patients involved in four weeks of mental rehearsal of upper limb movements during 45-minute supervised sessions three times a week and structured independent sessions twice a week, compared to 31 patient who performed equally intensive non-motor mental rehearsal, and 32 patients receiving normal care without additional training.

Results: No differences between the treatment groups were found at baseline or outcome on any of the outcome measures.

Conclusions: Results suggest that mental practice with motor imagery does not enhance motor recovery in patients early post-stroke. In light of the evidence, it remains to be seen whether mental practice with motor imagery is a valid rehabilitation technique in its own right. The clinical implications of the apparent complex interaction between mental and physical practice and possible implications for the neuroplasticity account of motor imagery will be discussed.

Episodic memory decline in Idiopathic Non-dementing Parkinson's disease: Challenging assumptions and implications for rehabilitation.

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Objectives: Idiopathic Nondementing Parkinsons disease (INPD) is marked by a progressive decline in episodic memory, defined as the capacity to mentally represent and become aware of episodes in the past, contextualised by associative information such as where and when the event took place. The decline in episodic memory has typically been investigated in medicated patients, and attributed to dopamine depletion in prefrontal-mediated strategic memory circuits implicated in the generation of encoding and retrieval strategies. Predictions arising from this are that drugs which restore dopaminergic modulation (of prefrontal-strategic memory processes), and training in the development and use of externally-generated memory strategies, should remediate INPD-dependent episodic memory decline.

Method: Two studies are reported. In the first, recollection of episodic details was assessed in INPD patients ON- and OFF-medication, and matched healthy controls (HC). The second study compared externally-generated guidance at encoding and retrieval with spontaneous encoding and retrieval on recollection in medicated-INDP and HC.

Results: Study 1 revealed that (certain types of) dopaminergic medication **increased** rather than remediated **the severity** of a INPD-dependent episodic memory decline. Study 2 showed that "acting as the frontal lobes" by providing optimal encoding and retrieval strategies **did not** improve recollection **significantly more** in INPD than in HCs.

Conclusions: Findings from both studies question assumptions made about effects of dopaminergic drugs and cognitive mechanisms underlying episodic memory decline in INPD, and that memory rehabilitation will require careful management of drug regimen, training in use of memory strategies as well as psycho-education to manage expectations .

Executive functioning and activities of daily living in early dementia: a correlational meta-analysis

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Objectives. A large body of research supports the clinical observation that people with dementia decline in activities of daily living (ADL). A growing number of studies link executive dysfunction with declining ADL skills and abilities in dementia. This meta-analytic study investigated correlations between tests of executive function and measures of ADL in early dementia.

Methods. Three databases were searched, 40,790 abstracts were screened, and 35 studies met inclusion criteria. Correlations between scores on tests of executive function and scores on measures of ADL were computed and used as an index of effect size.

Results. A total of 2013 people with dementia took part in the 35 studies. Fourteen different executive tests were used, to investigate the link between ADL and executive function, with verbal fluency and trail making the most frequently reported. Ten tests of executive functioning correlated with measures of ADL, while the four executive tests that did not correlate tended to have been used in few studies, representing a smaller aggregate sample size. Significant correlations ranged from .27 to .56, suggesting a moderate association between executive tests and ADL measures.

Conclusions. Most tests of executive functioning correlated significantly with ADL measures, supporting the growing evidence for a link between ADL and executive dysfunction in early dementia.

DAY 2: POSTER PRESENTATIONS

Structural MRI changes detectable up to ten years before cognitive impairment due to AD

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Objective. Brain structural changes detectable by MRI have been described in both Mild Cognitive Impairment (MCI) and Alzheimer's dementia (AD), i.e. in stages of the AD progression in which cognitive impairment becomes measurable clinically. Less is known on whether structural changes are detectable earlier, in the asymptomatic phase. Here we use structural MRI measures to identify brain changes occurring in cognitively healthy elderly at least 4 years before they developed cognitive impairment (MCI or AD).

Methods: One-hundred-forty-eight healthy, cognitively normal, community-dwelling participants underwent an MRI scan and neuropsychological examination and then were followed prospectively. Over 5 to 10 years, 32 subjects developed amnesic MCI (preclinical MCI) and 8 AD (preclinical AD). Voxel-based morphometry (VBM) and shape analysis were used to study brain volume and shape differences between preclinical AD and MCI and subjects who remained cognitively healthy for 10 years (HC).

Results: At baseline, before any symptoms, preclinical AD and MCI had significantly lower volume in medial-temporal lobes bilaterally, posterior cingulate and precuneus, and orbitofrontal cortex compared to HC, in absence of differences in demographic and global cognitive measures. In addition, when considering only those subjects diagnosed as AD later during the follow-up, significantly greater atrophy at the baseline was detected in the right medial-temporal lobe. Shape analysis confirmed that right hippocampal shape at baseline, measured using a deformable surface model, was significantly different in preclinical AD compared to HC.

Conclusions: Our results demonstrate that brain structural changes occur years before clinical cognitive decline in AD and are localized to regions affected by AD neuropathology

Home-based visual exploration training for patients with visual field deficits

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Objective. One of the most common consequences of stroke is partial visual loss, or hemianopia. Compensatory treatments teach the patients to make large eye-movements into the blind field and appear to be highly successful. They can be, however, expensive and time consuming. This study aimed to evaluate the efficacy and feasibility of a new computerised compensatory treatment for hemianopia which can be administrated by the patients themselves in their own home without a therapist being present.

Method. Forty-eight hemianopic patients were randomly assigned to one of two groups: the treatment group received 21 hours of visual exploration training and 14 hours of reading training. The control group received 35 hours of a placebo which did not involve visual exploration. Visual abilities were assessed before and after the training using: Goldman perimetry, visual exploration, reading, activities of daily living and attention tasks.

Results. The patients in the experimental group demonstrated significantly improved reading skills, faster visual exploration speed as well as higher mental flexibility. The placebo training had no effect on the control group.

Conclusions. The results showed that computer-based interventions can provide a cheap, accessible and effective treatment for patients with hemianopia.

[Supported by NIHR *PB-PG-0407-12038*.]

Investigating functional vision in Posterior Cortical Atrophy: Perception of faces, scenes and objects.

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Objectives: Posterior cortical atrophy (PCA) is characterised by progressive visual dysfunction and parieto-occipital atrophy, most often due to Alzheimer's disease. Previous investigations tend to use formal neuropsychological tests, however these do not always reliably predict visual ability in everyday life. Here we aimed to widen our understanding of visual deficits in PCA using more naturalistic pictures.

Methods: Data was collected from six participants who had a clinical diagnosis of PCA due to probable Alzheimer's disease and had completed a background neuropsychology battery. Three types of stimuli were chosen; faces (Minear & Park, 2004, Tottenham et al., 2009), scenes and objects, presented in colour and greyscale. Each had two subcategories, with three forced choice options. Participants responded verbally, and accuracy and reaction time were measured.

Results: Accuracy differed across stimulus category between patients. Patient 5 was significantly more accurate for objects than faces showed no significant difference between performance in the objects and scenes or faces and scenes conditions. In contrast, Patient 6 was significantly more accurate for faces than objects and faces than scenes, but showed no difference between objects and scenes.

Conclusions: The results show heterogeneity between patients, with some performing well at this categorisation task, and others showing deficits in both accuracy and reaction time. Dissociations between the perception of faces objects and scenes likely to be due to variation in the loci of greatest atrophy. Understanding individuals' specific visual impairments has implications for management of visual deficits and the design of visual aids to improve independence.

Integrating neuropsychology into stroke rehabilitation: the Dressing Rehabilitation Stroke Study (DRESS) pilot randomised trial.

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Objectives: A recurring problem in treatment of cognitive impairments is that effects of therapy show poor generalisation beyond training tasks. The best approach may therefore be to integrate training into therapy for activities of daily living. Dressing problems after stroke are common and more persistent in patients with cognitive impairments. This trial compared the conventional approach to dressing therapy with a neuropsychological approach to overcome the impact of cognitive deficits on dressing performance.

Methods: Consecutive patients with persistent cognitive and dressing difficulties 2 weeks post stroke were randomly allocated to receive 6 weeks of conventional dressing practice or a neuropsychological approach based on analysis of the nature of their dressing problems and cognitive testing. Treatment was given 3 times a week in accordance with prepared manuals. Patients were blind assessed at six weeks after randomisation.

Results: Seventy patients were randomised and 29 had a right hemisphere lesions. Both groups improved their dressing performance over the treatment period and there was no significant difference between them on the Nottingham Stroke Dressing Assessment at the 6 week outcome. However, the right hemisphere patients in neuropsychological group showed a significantly greater improvement on a line cancellation test for visual neglect and a trend towards better dressing outcome.

Conclusions: These results are consistent with our earlier single case design experiments and support the need for a phase III study focussing on patients with right hemisphere stroke and visuospatial impairments. More generally, this study demonstrates the potential of integrating cognitive interventions into occupational therapy.

Neuropsychological rehabilitation of anosognosia for hemiplegia: Suggestions for future therapies

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Objectives: Patients with anosognosia for hemiplegia (AHP) after stroke are unaware of severe physical deficit(s). They represent a “treatment paradox”, in which patients refuse therapy because they fail to appreciate the reason for their treatment. As such, unawareness is a significant barrier to rehabilitation in the acute and sub-acute stages of stroke, leading to poorer functional recovery and prognosis. Unfortunately, few suggestions have been made regarding the appropriate treatment of AHP. We therefore aimed to translate recent empirical research into suggestions for the rehabilitation of patients with AHP.

Methods: Recent research conducted by the authors was combined with a literature search undertaken using *PubMed* and *Web of Knowledge* and key terms “anosognosia”, “unawareness”, “stroke”, and “rehabilitation”. This research was used to identify key deficits in AHP and suggest methods by which recent empirical findings might be translated into AHP rehabilitation.

Results: Guidelines for treating AHP were found to be emergent, but not well established, or linked to specific empirical studies. Using empirical findings we suggest potential rehabilitation strategies for AHP in three functional domains: awareness, motor function, and emotional / motivational disturbance.

Conclusions: We recommend a rehabilitation strategy for AHP that: (i) involves careful evaluation of unawareness and concomitant deficits, (ii) is guided by knowledge of the mechanisms underlying unawareness, and (iii) is tailored to improve awareness, motor function and emotional / motivation influences. Further research is needed to evaluate the feasibility, effectiveness and impact of these suggestions.

Differential cognitive profiles between patients with schizophrenia and bipolar disorders: Evidence from prospective memory

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Objectives: Most recent evidence also suggests schizophrenia and bipolar disorders present a clinical continuum with partially overlapping in various domains including genetics, symptom dimensions, neurocognitive deficits, and treatment responses. This study attempted to examine the potential differential deficits of a prospective memory (PM), the ability to remember for the future, between patients with schizophrenia and bipolar disorders.

Methods: 58 participants (19 schizophrenia, 19 bipolar disorders, and 20 healthy controls) were recruited from a well-established early intervention programme for psychosis in Hong Kong. Participants were matched in gender and age. A computer test specifically capturing the time-based, event-based, activity-based PM components were administered to all participants on an individual basis. Each participant also received a full set of neurocognitive functioning test assessing IQ, memory and executive functioning.

Results: A MANCOVA analysis controlling for education and IQ indicated that there was no significant difference among groups in time-, event-, activity-based PM or PM composite score. However, there were subtle impairments of PM in patients with bipolar disorders compared to healthy controls (perceptual event-based PM, $p = 0.094$), and schizophrenia compared to controls (semantic time-based PM, $p = 0.061$). An examination of other neurocognitive functions also indicated that there were significant differences among the three groups in visual reproduction immediate recall ($p = 0.047$), letter-number span longest passed ($p = 0.026$), and Wisconsin Card Sorting Test perseverative error ($p = 0.017$), there was a trend toward significant difference in visual reproduction delayed recall ($p = 0.057$). Further analysis revealed that for visual reproduction immediate recall, bipolar performed poorer than schizophrenia patients ($p = 0.03$); for visual reproduction delayed recall, bipolar performed poorer than controls ($p = 0.019$); for letter-number span, bipolar performed poorer than controls ($p = 0.007$); for WCST perseverative error, schizophrenia had more errors than controls ($p = 0.031$) and bipolar patients ($p = 0.006$).

Conclusion: These current findings are consistent with the previous findings that patients with bipolar disorder and schizophrenia both share neurocognitive deficits. However, these two clinical groups demonstrate a qualitatively different neurocognitive profile. Specifically, there is also a continuum of dysfunction along which patients with schizophrenia consistently manifest the most severe impairments, and bipolar disorders, on average, showing a similar but attenuated pattern of dysfunction.

Examining reading deficits in the visual variant of Alzheimer's disease

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Objectives: Posterior Cortical Atrophy (PCA), widely regarded as the visual variant of Alzheimer's Disease (AD), involves a selective visual impairment while leaving language and memory functions relatively spared. The aim of this investigation is to identify patterns of reading deficits in individuals with PCA in order to better understand how such deficits relate to dysfunction in other parts of the visual system.

Methods: The participants recruited for this study were 20 individuals with PCA, 20 patients with typical AD and 20 age-matched controls. Single-word reading (N=196) tasks examined the effects of font, size, spacing, word length, case and letter confusability on accuracy and latency. Participants also completed letter processing tasks under conditions of visual crowding, temporal masking and contrast sensitivity.

Results: Preliminary results from 4 participants show a significant effect of font size on reading accuracy, with larger font words counterintuitively being read less accurately than smaller words (mean 22.9% vs 54.2%, $p < .05$). Word spacing also had a significant impact upon reading accuracy, with words with spaced letters being named correctly less often than unspaced words (mean 34.9% vs 59.9%, $p < .05$). Word length, case and letter confusability had no significant effect on reading performance.

Conclusions: Results confirm a common clinical complaint of finding large text harder to read than small print, and may reflect a progressive attentional restriction in the effective field of vision. We hope that further results will help clarify how other factors influence reading accuracy, which might inform the design of reading strategies and remedial techniques.

Automatic Guidance of Auditory Attention from Working Memory

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Objective: There are many researches demonstrate that working memory plays an important role in top-down attentional guidance. The present study sought to investigate whether the maintenance of a sound in working memory attracts our attention in auditory space? Additionally, are there cross-modal links between working memory and selection? Does the maintenance of an auditory stimulus attract attention to the equivalent visual stimulus and to semantically stimulus as well?

Methods: We tested performance in an auditory search task, in which we asked participants to memorize a sound (prime) and then we asked them to search for a target sound in a search field of different sounds to assess whether the stimulus in WM influenced search efficiency. Then, the influences of visual and semantic prime were tested on finding target in an auditory search field. In all three experiments, the bottom-up effect and automaticity were controlled separately.

Results: RTs were analysed for correct responses in the search-identification task and paired-sample t-test was used to compare mean of RTs in different conditions. In the analyses p values of main effects have been computed. Pairwise comparisons showed faster performance in the Valid trials than Invalid trials and Neutral trials.

Conclusion: The effects of the contents of WM on attention have been studied within auditorial modality. Additionally, cross-modal links between WM and selection has been studied. The results showed that the maintenance of an auditory stimulus attract attention to the equivalent visual and semantic stimulus.

Thalamic lesions impair memory guidance of visual selection

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Objective: Functional magnetic resonance imaging (fMRI) research suggests that guidance of attention from the contents of working memory (WM) engages a complex network including frontal areas in dorsolateral prefrontal cortex (DLPFC), superior frontal gyrus (SFG), middle temporal regions, thalamic nuclei and occipital visual cortex. However, evidence from fMRI is only correlational and therefore it is difficult to determine which of the identified brain regions are necessary and causally involved in WM guidance of attention. This issue was addressed in a lesion study with focal-lesion stroke patients.

Methods: A total of 67 patients were tested. Patients were required to perform a visual search task for a target object presented amongst distracters. In the valid condition the colour of the sought after target was pre-cued by a verbal cue presented prior to the search display. On neutral trials, the patients did not receive any cue prior to search. Voxel-based lesion-symptom mapping (VLSM) analyses were carried out to relate lesion anatomy to search behaviour.

Results: The VLSM analyses revealed that patients with thalamic lesions (N=4) showed no memory cueing effect of search despite having intact memory performance in a control memory task. In contrast, the control patients were able to use the memory cue to guide attention towards the target, as indexed by faster reaction times on valid relative to invalid trials.

Conclusion: The findings support the role of the thalamus in controlling visual attention, specifically in guiding attention based on relevant information held in memory.