Keyword 2: chronic pain
Keyword 3: aging (normal)
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57 Sensitivity of functional Near-Infrared Spectroscopy in Individuals with Posterior Cortical Atrophy

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Objective: Functional near infrared spectroscopy (fNIRS) is a form of non-invasive neuroimaging that uses light to measure changes in oxygenated and deoxygenated hemoglobin (Yucel et. al., 2021). Relative to fMRI, fNIRS is significantly cheaper and less susceptible to motion artifacts thereby enabling researchers to acquire data in more ecologically valid environments and has a higher temporal resolution that makes it well-suited for connectivity analyses (Tak and Ye, 2014). fNIRS is, however, uniquely limited by cortical anatomy. With a typical probe array having a penetrance depth of up to 3cm, the benefits of fNIRS may be limited by the neocortical atrophy that is characteristic in those with neurodegeneration. We present preliminary findings comparing fNIRS probe sensitivity in older adults diagnosed with posterior cortical atrophy (PCA) relative to cognitively intact older adults using Monte Carlo (MC) simulations. MC simulations offer probabilistic models that simulate photon movement through tissues of interest. We were particularly interested in fNIRS' sensitivity in the occipitoparietal cortices since these are regions characteristically affected in PCA.
Participants and Methods: We acquired high resolution structural (T1) MRI on 3 cognitively intact older adults and 3 individuals who received a clinical diagnosis of PCA according to Crutch et al. (2017) criteria. Individual T1 scans were preprocessed and transformed into a two-dimensional (2D) surface using FreeSurfer. This continuous 2D surface was then segmented into its main tissue priors, as well as its pial surfaces. Segmented MRIs were then imported into AtlasViewer software and registered to our full head fNIRS probe array via an affine transformation. We embedded the GPU-accelerated Monte Carlo Extreme 3D light transport simulator software (Fang and Boas, 2009) into AtlasViewer which enabled us to launch 10 million photons from each optode, compared to the 1 million that AtlasViewer is set to by default, thereby providing more accurate results (Aasted et. al., 2015). We then assessed the sensitivity profile (log units), a mathematical estimate of optical density, of the inferior and superior occipital gyri, middle occipital gyrus, the superior and inferior parietal lobules, and left and right precunei.
Results: Among the regions interrogated, five channels on our fNIRS probe were markedly different between the controls and those with PCA. Specifically, sensitivity values for channels covering the right inferior (hedges g = 8.04) and left superior occipital gyrus (hedges g = 2.46), the right inferior parietal lobule (hedges g = 8.89), and the right (hedges g = 9.43) and left (hedges g = 14.83) precunei were all markedly lower in those with PCA.
Conclusions: We provided preliminary evidence that the sensitivity of fNIRS appears to be markedly reduced in those with PCA. This is especially relevant for researchers using fNIRS in populations with neurodegeneration. Future work will evaluate these findings in a larger sample as well as in other neurologic conditions with the goal of helping researchers appropriately power their studies and interpret their results.

Categories: Neuroimaging
Keyword 1: neuroimaging: functional
Keyword 2: aging disorders
Keyword 3: dementia - Alzheimer's disease
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58 Hippocampal Subregions Predict Executive Function Across the Adult Lifespan

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Objective: Executive function is known to decline in later life, largely attributed to structural and functional changes in the prefrontal cortex. However, other regions of the brain are integral to executive functioning, including the hippocampus. The hippocampus plays a large role in memory but its intricate connections to limbic regions including the prefrontal cortex likely underlies associations between the hippocampus and executive functions. Due to the hippocampus' complex structure, hippocampal subregions may be differentially associated with executive function, but this possibility remains largely unexplored. Therefore, we examined the association between volume of the hippocampus and its subregions with executive function to understand these relationships across the adult lifespan.
Participants and Methods: The study included 32 healthy, community-dwelling participants (age range = 18-81, mean age = 51.06 ± 20.98, 91% white, 72% female) who received a 3-Tesla magnetic resonance imaging (MRI) scan and completed a cognitive battery. We calculated an executive composite based on Trail Making Test Part B and the interference score from the Stroop Color and Word Test. Freesurfer (version 5.3) as used to quantify total hippocampal volume and subfield volumes for CA1, CA2-3, CA4-dentate gyrus, subiculum, and presubiculum. We conducted mixed-effects regression analyses with total hippocampal and subfield volume, age group (young, middle-aged, and older), and their interaction predicting the executive function composite, controlling for total intracranial volume.
Results: Larger hippocampal subregion volumes in CA1 ($p = 0.03$), the subiculum ($p = 0.01$), and the CA4-dentate gyrus ($p = 0.04$) predicted better executive function. Total hippocampal volume and the presubiculum were not significantly associated with the executive function composite. The age group interaction was not significant for any of the models. Follow-up analyses by hemisphere showed that the effects were right lateralized in CA1and CA4-dentate gyrus, and bilateral in the subiculum.
Conclusions: These data support the literature demonstrating the involvement of the hippocampus in executive function and demonstrates variation across hippocampal subfields. The lack of significant age interactions suggests these relationships may not differ across the lifespan, although this finding would need to be replicated in larger samples. These findings support previous literature showing CA4-dentate gyrus' association with neurogenesis may facilitate better executive function by increasing connection strength among CA1, CA2-3, and the frontal cortex. This study contributes to our understanding of how specific hippocampal subregions relate to executive function, which has both clinical and research implications.

Categories: Neuroimaging
Keyword 1: hippocampus
Keyword 2: executive functions
Keyword 3: aging (normal)
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59 Investigating the Relationship Between Neuropsychological Test Performance and Electrophysiological Measures of Semantic Functioning in Alzheimer's Disease.

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Objective: Improving the timeline for intervention in Alzheimer's disease (AD) has considerable potential to delay and mitigate disability and suffering. Neuropsychological assessment is useful for distinguishing AD from normal aging and other dementias but is less useful in preclinical detection due to its limited sensitivity. The N400 (N4), a language-based EEG event-related potential (ERP) related to semantic functioning, is a promising candidate marker of AD with potential to improve early detection and monitoring of AD. For example, studies have shown that individuals with AD show a reduced N4 "effect"—a smaller

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