**Symbol Digit Modalities Test and Effective Connectivity of Information Processing Speed**

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**Introduction:** The evaluation of the Effective Connectivity is relevant for neurological diseases, such as Multiple Sclerosis (MS), since its assessment over time may indicate the occurrence of adaptive neuroplasticity [1]. Therefore, this study aims to investigate, in healthy volunteers, the effective connectivity between regions activated during the performance of an adapted version of the Symbol Digit Modalities Test (SDMT), an international gold standard for screening of Information Processing Speed (IPS) of MS patients.

**Materials and Methods:** Eight right-handed controls were recruited and underwent a cognitive evaluation with an oral version of the SDMT before image acquisition. MRI was acquired in a 3T Philips Achieva System. BOLD images were acquired with a 2D EPI sequence. The experiment consisted of six 30-second blocks of control, intercalated with five 30-second blocks of task (SDMT). During the task blocks, a symbol was displayed every 2 seconds, and the participant was asked to associate the number corresponding to the displayed symbol based on a response key. During the control blocks, a number was displayed every 2 seconds, and the participant was asked to silently read the number displayed. In the SPM12 software, after the usual preprocessing, statistical maps were obtained using a voxel-wise GLM with a boxcar regressor convolved with a canonical hemodynamic response function (p-FWE < 0.05). Dynamic causal modeling considering two hypothesized models of network structures for IPS was implemented and Bayesian Inference was applied between the two models for comparison.

**Results:** Activations were observed in the frontoparietal network and occipital cortex for the individual and group analysis. Highest evidence for a system architecture featured the lingual gyrus in a serial position between cuneus and two parallel regions (precuneus and superior parietal lobule), from which information, modulated by the SDMT task, converges onto the inferior frontal gyrus, cerebellum and finally bifurcates into right and left middle frontal gyri.

**Discussion:** The IPS system identified in meta-analysis studies demonstrated robust activation in our experiments, showing that our SDMT adaptation is consistent, despite methodological differences and different sample sizes. Functional architecture of IPS and the effective connectivity within it have been studied with hypothetical and preliminary network structure models. Studies with other models will be needed to better delineate the functionality of each core that makes up the network and its role within the IPS task.

**Conclusion:** Preliminary data show activations in the frontoparietal network and occipital cortex as observed in previous studies [2,3]. A likely network model with areas involving IPS was obtained and may serve as a reference for future investigations of this cognitive process in MS. We are still testing other possible networks, and more data is being acquired to improve our statistics.

**References:** [1] Chiaravalloti ND et al., Front Neurol 6:67, 2015. [2] Forn C et al., Brain Cogn. 82:152, 2013. [3] Forn, C et al., J Clinic Exp Neuropsyc 33:1, 2011.