Reading

Learning to read requires children to link print (orthography) with its corresponding speech sounds (phonology). Yet, most EEG studies of reading development focus on emerging functional specialization (e.g., developing increasingly refined orthographic representations), rather than directly measuring the functional connectivity that links orthography and phonology in real time. In this proof-of-concept study we relate children's reading skill to both orthographic specialization for print (via the N170, also called the N1, event related potential, ERP) and orthographic-phonological integration (via dynamic/event-related EEG phase synchronization - an index of functional brain network connectivity). Typically developing English speaking children (n = 24; 4-14 years) and control adults (n = 20; 18-35 years) viewed pseudowords, consonants and unfamiliar false fonts during a 1-back memory task while 64-channel EEG was recorded. Orthographic specialization (larger N170 for pseudowords vs. false fonts) became more left-lateralized with age, but not with reading skill. Conversely, children's reading skill correlated with functional brain network connectivity during pseudoword processing that requires orthography-phonology linking. This was seen during two periods of simultaneous low frequency synchronization/high frequency desynchronization of posterior-occipital brain network activity. Specifically, in stronger readers, left posterior-occipital activity showed more delta (1-3Hz) synchronization around 300-500 ms (simultaneous with gamma 30-80 Hz desynchronization) and more gamma desynchronization around 600-1000 ms (simultaneous with theta 3-7Hz synchronization) during pseudoword vs. false font processing. These effects were significant even when controlling for age (moderate - large effect sizes). Dynamic functional brain network connectivity measures the brain's real-time sound-print linking. It may offer an under-explored, yet sensitive, index of the Neuroplasticity associated with reading development [1)].

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Panda EJ, Kember JD, Emami Z, Nayman C, Valiante TA, Pang EW. Dynamic functional brain network connectivity during pseudoword processing relates to children's reading skill. Neuropsychologia. 2022 Feb 12:108181. doi: 10.1016/j.neuropsychologia.2022.108181. Epub ahead of print. PMID: 35167858.