An fMRI study of the procedural learning deficit hypothesis in Developmental Coordination Disorder and/or Developmental Dyslexia

Introduction: Understanding the reasons of frequent co-morbidity in Developmental Coordination Disorder (DCD) and Developmental Dyslexia (DD) is an actual challenge for both theoretical and practical reasons. Their association (40 to 60%) suggests that etiological bases are partly common. In this context, Nicolson & Fawcett (2007) suggested a specific disorder of procedural learning. However the brain networks involved in this learning could be achieved separately, namely cortico-striatal and cortico-cerebellar loops. We intend to study the neural networks involved in motor procedural learning and compare these networks among children with specific learning disorder alone or in association. We consider how the neural activity differs or shares commonalities depending on the learning processes.

Methods: 65 right-handed children were recruited. Inclusion criteria were: 8 to 12 years old, with DCD or DD or DCD and DD. They had no history of neurological or psychiatric disorder and no contraindication for MRI. Children with Specific Language Impairment, Attention Deficit/Hyperactivity Disorder or Mental Retardation were excluded. Motor tasks during fMRI included three different conditions that were administered in a counterbalanced order. In the first condition, children realized continuously, and as fast and accurately as possible, a simple and highly automatized finger sequence, previously learned during fifteen days. In the second condition, participants had to execute a newly just learned finger sequence The third one is a control condition where children had to perform random tapping. For each run, subjects alternated 6 epochs of 30 s of rest and 30 s of motor tasks. Finally only 56 children (19 DD, 20 DCD and 17 DD+DCD) were included in the study. Nine children were excluded for incomplete assessment or excessive movements in fMRI. Results: Data analysis is currently in progress. The statistical parametric mapping software (SPM8) was used for both individual and group analyses of the functional imaging data. We expect differences in brain activity according to the three groups of disorders (DD, DCD or both) and to the type of motor sequences (random, new learned, automated condition), specially in cortico-striatal and cortico-cerebellar loops. Our central interest is to precisely identify the effects of the co-morbidity on brain organization with regard to a possible additive effect.

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